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Electrical World

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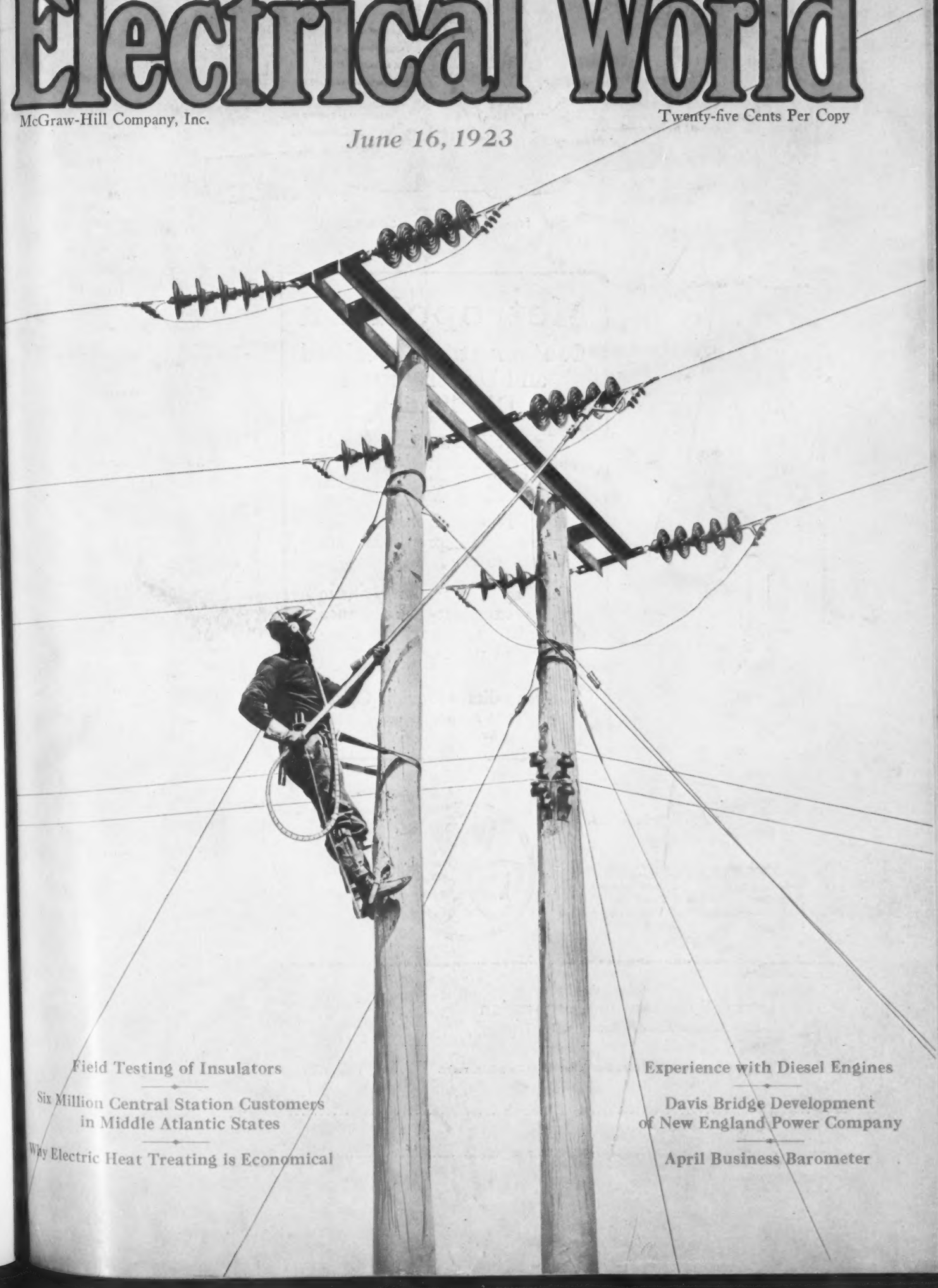

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Why Electric Heat Treating is Economical

Experience with Diesel Engines

Davis Bridge Development of New England Power Company

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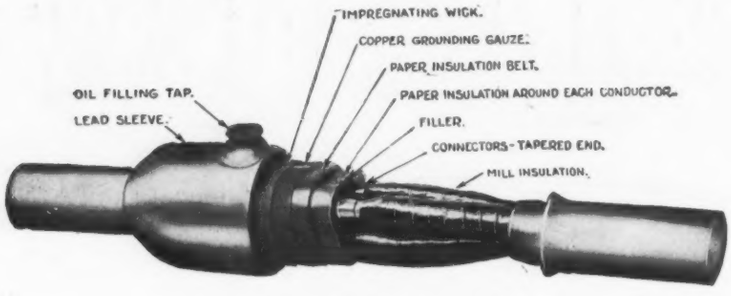

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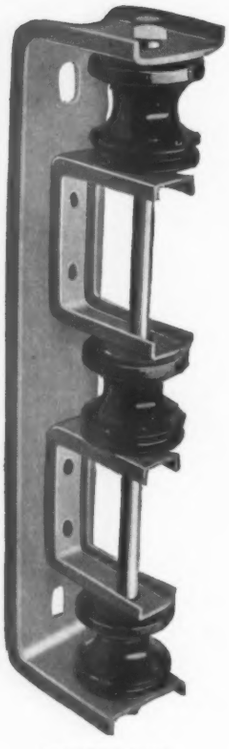

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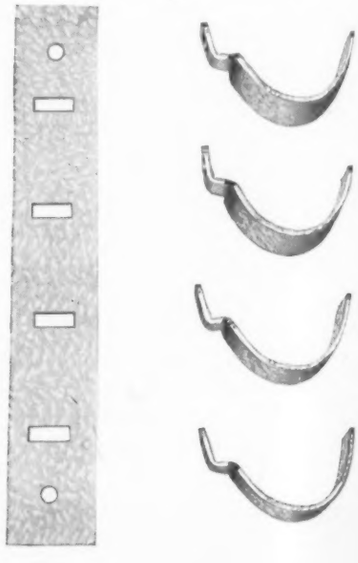

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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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Public Relations—Close Up

THE topic upon everybody's tongue at the great convention in New York was public relations. Public utility men, central-station executives were all talking about it. The problem of serving the public heartily and of intelligently interpreting this service to the public received the most conspicuous attention.

Public relations has come to be a very big thing in the light and power business. But really public relations is not one big thing at all. It is a very great many little things.

OUT in Omaha, as an example, the Nebraska Power Company believes that the secret of public relations is to take care of customers when they are in trouble. And so it maintains a staff of motorcycle men to answer trouble calls, just as many other companies do. But as Vice-president J. E. Davidson puts it: "It isn't so much what you do as the way the thing is done that registers with the public." Therefore the Omaha company has made it the objective in these trouble calls not only to go and straighten out the troubles but to surprise and please the customer with the spirit of the service.

A telephone call comes to the Nebraska Power Company's switchboard. Mrs. Ray is giving a party and the lights have gone out. "I'm awfully sorry!" says the girl; "I'll send a man at once"—a sympathetic and personal response.

The two best troublemen are on duty at night, so placed and trained that any residence in town can be reached within ten minutes. In five minutes perhaps a motorcycle thunders up, the doorbell rings, and the Nebraska Power man is there, expresses sympathy, renews the fuse, asks if there is anything else that he can do and leaves.

He makes the same fast time back to his post and reports to the switchboard girl. In, say, about eight minutes after Mrs. Ray has thanked him and closed the door her telephone rings. It's the Nebraska Power girl, still much concerned. "Has our man arrived? He has? I'm so glad! Is everything all right? Can we do anything more?" In short, within, say, twenty minutes the man has come and gone and all is well and a sweet voice from the company has followed up, full of concern. And every call makes one more friend.

SUCCESS in building up good public relations is the good relationship between the individual representatives of the company and the individual customers. But we the public utility employees are naturally absorbed in our own work and apt to be forgetful of these little incidental courtesies. And we the people are no less absorbed in our own affairs and apt to accept these services as a matter of course and also to be supercritical. The maintenance of harmony in all these contacts is therefore not only an important but a very difficult responsibility.

Public relations everywhere and every day depend on putting extraordinary heartiness and helpfulness into the ordinary human intercourse between all the men and women of the company and all the men and women of the city. It is not done, it never will be done, unless the chief executive of the utility makes it his own concern and leads and guides in both the planning and the performance of it.

Ray Palmer

A man who as consulting electrical engineer, head of metropolitan department and president of a great central-station system has achieved a triple success.

RAY PALMER, president of the New York & Queens Electric Light & Power Company, which serves 108 square miles of territory in New York City, was formerly Commissioner of Gas and Electricity of Chicago and in that capacity evolved and completed what has been termed the most nearly perfect system of municipal lighting in the world. In addition he reorganized the Department of Gas and Electricity into separately working divisions of electric wiring and repairs, operation and maintenance, engineering and construction, lighting, fire alarm and electrical inspection, which resulted in a large saving to the city. Mr. Palmer fought incessantly for the passage of an ordinance to combat electrolysis which was opposed by the street and elevated railways but was finally passed. It conferred many benefits and saved the city and the public utilities, as well as the owners of steel structures, a large sum of money each year. He also fought for reasonable regulation of public utility rates. After resigning from the position of Commissioner of Gas and Electricity, Mr. Palmer practiced as an electrical engineer in Chicago for a short time until on Nov. 1, 1915, he was chosen vice-president and general manager of the New York & Queens company. He was advanced to the presidency Sept. 19, 1916.

Mr. Palmer was born in Sparta, Wis., March 29, 1878, and was graduated from the University of Wisconsin in 1901 as an electrical engineer. He was for a time assistant superintendent for J. G. White & Company on substation installation work in New York City, and after the completion of this work he continued on the firm's engineering staff in London, England. He was later appointed electrical engineer of the Union Traction Company of Chicago, but left that organization to open an office as a consulting engineer in Chicago and Milwaukee and continued in private practice until his appointment by Mayor Carter Harrison to head the Chicago Department of Gas and Electricity. This appointment was entirely unsolicited and came as a surprise to Mr. Palmer, who had had no thought of holding public office and was able to work for the good of the city as he saw it without being trammeled by political obligations.

Mr. Palmer is a fellow of the American Institute of Electrical Engineers and a member of the Illuminating Engineering Society, the National Electric Light Association, the New York Electrical Society, the Engineers' Club of New York, the Engineers' Country Club, the Flushing Country Club and the Bayside Yacht Club.

Editorial Comment

Electrical World, June 16, 1923

Volume 81 Number 24

A National Survey of Electric Service

AN EXCELLENT suggestion for satisfying the millions of users in this country that the electric light and power companies mean to give the best possible service was made by M. H. Aylesworth at the convention of the National Electric Light Association last week. Carried out in the right spirit, a country-wide survey ought to work wonders for the industry nationally just as it has locally whenever and wherever it has been tried. To get acquainted with each customer, ascertain his wants, and to show by word and deed an interest in him cannot but result in fostering a spirit of good will. Of course, all depends on how the thing is done. The idea will "go over big" if the utilities go about it frankly and honestly for the good of the service. The value of good public relations is generally conceded, and Mr. Aylesworth's suggestion not only comes at an opportune time but has advantages that loom greater and greater the more one considers it. We are glad that the plan is to be carried out under the direction of the Public Relations National Section of the N. E. L. A. and with the active co-operation of the Commercial Section. It is worth all the effort that can be put in it.

One Million Words! How Many Will Be Effective?

A FAIR estimate of words spoken in the regular convention program last week would surely approach the million mark. Think of the stenographic service—to say nothing of the mental effort of the speakers! Is it all to good purpose? That depends on how many words were caught—how many ideas will be applied. It behooves every one to utilize them to the utmost!

The Medal of the Southern California Edison Company

IT IS particularly gratifying that the first medal awarded by the Coffin Foundation should be given to the Southern California Edison Company of Los Angeles. We doubt whether in the short time at its disposal the committee could have reached such a decision were the company not generally recognized as one of the most progressive and enterprising in the world. This applies to its executive, engineering, operating and business departments. The company's program for water-power development is far-sighted and mapped out ten years in advance. Its transmission lines operate at the highest voltages in use. In the matter of public relations the Southern California Edison Company has been a leader in the industry, and as for popularizing the use of electricity few companies can approach its record for household saturation. Its customers as well as its employees have bought freely of its securities and in the last election fought valiantly in its defense. This, after all, is the best evidence of a company's standing and worth in the community.

The Southern California Edison Company has shown commendable faith in the people of California and has well deserved the honor bestowed on it. The whole industry takes pride in its accomplishments.

On a Partnership Basis

A PREDICTION that within three years' time a million of their customers will own securities of the light and power companies was made in the report of the customer-ownership committee of the National Electric Light Association. With more than 425,000 customer-owners added as investors in these securities, and with the astounding growth and popularity of the movement, such a prediction would seem to be conservative. What a remarkable vista opens to the utilities under these conditions! Financing from local territories in quantities as needed and at low rates is only the least of the things gained. Public relations are sure to be improved by the association of customers with the utilities, and the utilities to be inspired to new heights of efficiency by the knowledge that, through security ownership, their customers are part and parcel of the organization and will, as partners, keenly scrutinize its work.

This whole movement is one of those miracles that occur in the electrical industry at needed intervals to revive and reinspire it and further its progress toward the goal of an electrified America with all the incidental high standards of living that this implies. The leadership that grasps these constructive ideas and carries them through to success cannot fail to safeguard the movement and guide it along proper channels. Vision is lacking to predict the ultimate consequences of the great partnership now under way, but its conception is sound, its principles are correct and its ideal is good. The industry will reap as it sows.

"Electrifying" a River

WHEN the Davis Bridge hydro-electric plant of the New England Power Company shall be placed in operation some months hence another important step will have been taken in conserving the waters of the Deerfield River for the benefit of power users within transmission distance of this noted little stream. Readers of the article by Messrs. Eaton and Collins which describes this development will do well to study the profile diagram of the Deerfield and to note how logically the hand of the engineer is carrying forward what might be called the "electrification" of the river. Running south from the hills of Vermont and east from

the Berkshires of Massachusetts, this representative "flash" stream is being made to yield energy at every strategic point, so that when the program is completed no less than 110,000 kw. will be produced in a watershed of 550 square miles. Stabilization of flow through large reservoir construction at two places, combined with skillful development of heads on the way down the valley, tells the story.

The Davis Bridge station will be the largest on the system, surpassing even the Vernon plant on the Connecticut River. Instead of being regularly tied in with the adjacent 66,000-volt transmission lines of the company, it will be directly connected with the load center of the system near Worcester, Mass., by a 110,000-volt trunk line nearly 80 miles long. Flexibility and efficiency of operation, however, will be increased by autotransformer interconnection at Davis Bridge with the 66,000-volt ring transmission lines into which the other hydro-electric stations regularly feed. The hydraulic and electrical features of the development contain many points of interest, but in considering these details the relation of the development to the system as a whole and to the river itself should not be overlooked. The Deerfield program as a whole, when completed, will save New England about half a million tons of coal a year—an example of conservation reflecting great credit upon the financial and engineering interests which are working out this praiseworthy achievement.

Know the "Curbstoner" Better and Lift Him Up

IT IS said that 60 per cent of the wiring that is done in America is installed by small contractors who are not really organized into the electrical industry through membership in any association. They are "curbstoners" and other small contractors who have not felt the responsibility and the opportunity of the industry in the mass sense. They have not felt the impulse to affiliate with other contractors to promote co-ordination and co-operation in their calling. Here is a matter that deserves the very serious consideration of every one who is working to strengthen and build up at some point progressive organization among electrical men.

These small contractors are vitally important. They form the skirmish line for both the manufacturer and the jobber whose products must ultimately be sold to and installed in the homes and business places of the people. They provide a most intimate contact between the electrical industry and the public, but they are for the most part concerning themselves but little with any of the broader purposes of the industry. They are not thinking with the rest of us. They are not working with the rest of us. And so this great, active force of workers is not tied in and is not being applied.

There is much to be done in the interpreting of electric service to the people. Much is already being done to inform and educate and guide public opinion toward a clearer conception of the part that electricity is playing in our modern community and household life. It is a pity that all the influence of this small army of electrical workers whom the people know so well is not directed to the support of the central station and the promotion of the ideals of the industry.

But it is not a matter to be dismissed with a lament. Real progress can be made if the electrical family of each community will assume responsibility for meeting the condition in its own town by an active effort to know this small local wiring contractor better and to influence him to become a working member of the local family and to join his national association. The central-station commercial executive can well afford to take the initiative in such a work.

A Promising Co-operative Method That Is Often Neglected

CONSTRUCTIVE suggestion is better than destructive criticism, affirmation than negation, and sometimes it is speech, not silence, that is golden. Sight of these truths, however trite they may be, is lost by operating engineers and users of equipment who condemn manufacturers for not keeping designs of specified apparatus up to service requirements but do not take the trouble to point out to the makers the things that need remedy. Merely to discontinue the use of inadequate apparatus, saying nothing, is not the best way to bring about its improvement. Such a course denotes dissatisfaction no doubt, but affords the designer no clew as to its cause. To denounce a type of equipment in general terms is scarcely more helpful and does not prove that the fault is with the tool and not with its user.

Is not the right method—the only one that brings results—to make known to the manufacturer what the defects of his products, as manifested by operating experience, are? Of course, users of equipment cannot be expected to carry on research work for the manufacturers or to design equipment. That is not the idea, but simply that the results of their operating experiments and investigations be not locked in their own bosoms, as if these efforts were among the blunders worse than crimes, but told to the maker of the equipment concerned. Indeed, why should they not be freely and widely published? No individual manufacturer could then possibly profit by them at the expense of his own competitors, and the improved construction that would in many cases follow this public-spirited course would redound to the benefit of the entire industry.

Order Evolving in Reactive Metering

ORDER is gradually evolving from the efforts of the industry to provide a practical metering basis for either kilovolt-ampere-demand charges or power-factor rate adjustments. Whether clarification of the situation can be considered complete before a single standard practice has been adopted is an open question. Viewed from the angle of the lay consumer, however, a multiplicity of methods can hardly be conducive to easy progress of the tendency to differentiate in the bill between fixed and variable charges. Again, from the consumer's standpoint there should be as thorough simplicity of metering methods as of rate schedules. Simplicity obtained at the expense of certainty would, however, be false progress. It is unfortunately true that there are managers who will provide their billing clerks with adding machines and other appliances to insure 100 per cent accounting accuracy, but will, on the other hand, be content with mediocre meter accuracy.

Expediency has thus prompted the adoption of several of the reactive metering schemes now in vogue. Some of the common schemes involve inherent errors under conditions of unbalanced loads or voltages, and

these are not generally appreciated. The results of an investigation of metering methods by one of the large utilities show that the errors range from less than 2½ per cent for favorable load conditions to as high as 50 per cent under extreme unbalance, a true power factor of 50 per cent being indicated as 75.6 per cent by one of the reactive metering methods.

There remains, therefore, great room for improvement before reactive metering schemes can be used without a great deal of engineering skill, and a simple metering system which eliminates the errors is needed badly. Some very encouraging features of a new system appeared in the article by R. D. Evans in the Feb. 10 issue.

Reliable High-Voltage Cables Still in the Future

RARELY does an engineering problem resist the efforts of the specialists when an imperative demand exists for its solution, but in the case of the high-voltage cable for underground service long-continued effort has not yet produced a satisfactory answer. Operating companies could use this type of cable to advantage in overcoming existing distribution handicaps. Streets are becoming more congested with underground installations; power demands are increasing in magnitude; power plants are becoming larger and the cost of the low-voltage cable installations greater. Even now manhole fans, forced-air ventilation and water cooling are expedients forced on central-station companies in their effort to supply the power demanded by using available methods and equipment.

Of course, progress has been made and is still being made in the manufacture of cables. Several installations are now under way which use three-conductor cables rated from 30,000 volts to 35,000 volts, and in one instance operation is contemplated at 88,000 volts to ground. In one locality several miles of single-conductor, 66,000-volt cable is being installed. Such voltages are much higher than were considered practicable three years ago, and the improvement has been brought about by very skillful research work. Not only have dielectric losses been reduced and the dielectric strength increased, but manufacturing technique has been improved and a better knowledge exists of the phenomena of dielectric breakdown. On an operating basis for average temperatures and dielectric strengths, cables of still higher voltage are possible, but service reliability is jeopardized by the fact that local hot spots and mechanical imperfections may occur very frequently.

The report of the underground-systems committee of the N. E. L. A. shows that there has been a great deal of improvement in the mechanical perfection of cables and in methods of cable testing, but data compiled from representative installations shows that going to high voltages is accompanied by increased risks. On cables operating from 6,000 volts to 15,000 volts there were 10.8 failures per year per 100 miles of cable as compared with 15.7 failures on those operating between 10,000 volts and 33,000 volts. These data were taken over a five-year period and do not support any positive conclusions to the effect that the reliability of cables has been bettered since 1918.

Another interesting bit of data shows 3 and 7.8 as the average number of joint failures and cable failures respectively in the 6,000-volt to 15,000-volt class per 100 miles of cable and 7.1 and 8.6 for the same type of failures in the 20,000-volt to 33,000-volt class. Thus joint failures occur more frequently in the high-voltage type, and in both classes the cables fail more frequently than the joints.

An exact knowledge of the basis of breakdown for solid or semi-solid insulation made up of several constituents is as yet unknown to the specialists. Apparently it is physically impossible to eliminate the presence of air spaces between the conductors and the sheath, and the desired cable cannot be produced until the requisite fundamental knowledge and mechanical technique are available. We are told that European cable manufacturers make a product superior to that found in this country, but investigation shows little to support this conclusion. Comparisons show that American cables are more than equal in quality to the European, and American engineers have concluded that the solution of the problem rests with American and not with European manufacturers.

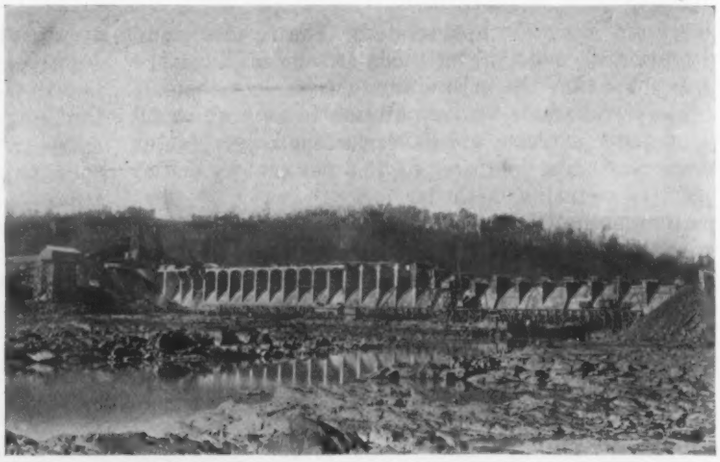
Further Insulator Research Is Needed

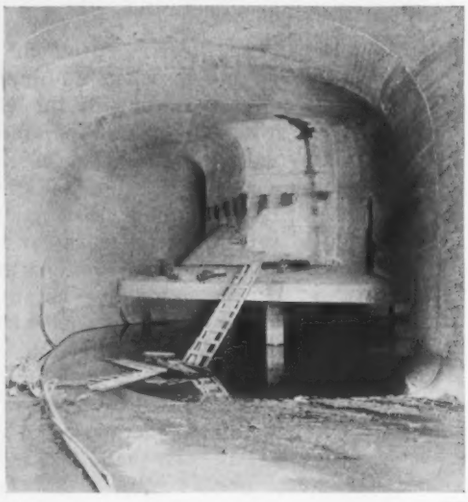
GRATIFYING progress in the testing of insulators on live lines is indicated in the article by F. C. Doble, published in this issue. Interest in this general subject has been mounting within the industry for several years, and as the importance of particular lines has increased the desirability—indeed, the necessity—of being able to test without shutting down has become compelling. Thus far this method has shown remarkable flexibility in its range of usefulness when applied to both pin-type and disk insulators and has effectively "weeded out" insulators secretly "planted" on tested lines, besides detecting others which have deteriorated in service toward the point of hazard to continuous line operation. The attention of safety experts may well be directed to the method described, which seems remarkably free from the limitations that have given trouble in the past.

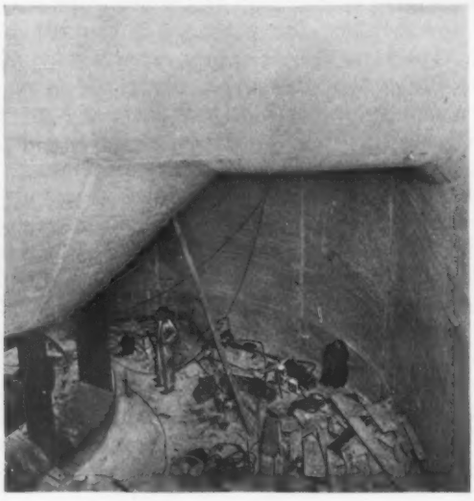
Mr. Doble's investigations have been pursued over several years, the later of which have been actively employed in field tests on commercial transmission lines illustrating typical Eastern and Middle Western conditions. They already indicate that the values of voltage distribution over insulators differ from the assumptions that have formerly been regarded as reasonably accurate. As this method is further utilized interesting data along this line may be expected.

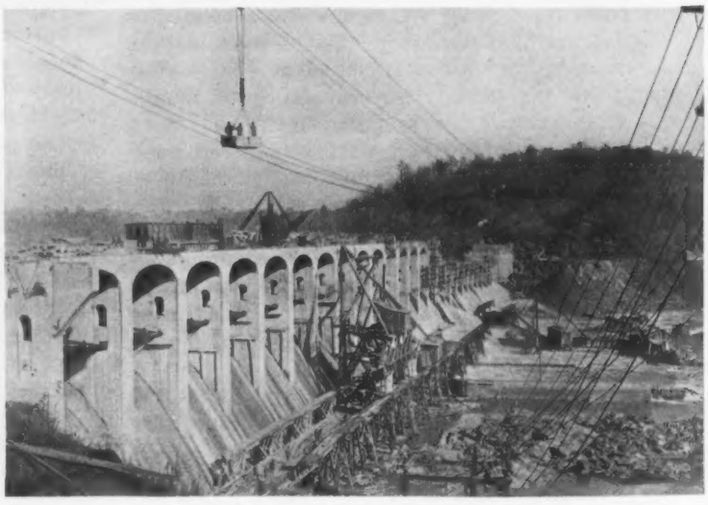
It is very much to be desired that some co-operative research be launched in the near future to determine the insulator conditions of deterioration which warrant removal of defective units from active lines. Tests show that many of these insulators are giving good service notwithstanding their deterioration from initial quality, and thus far operating men are obliged to use their own judgment, supplemented by that of testing engineers, in regard to the withdrawal of units from service. It is possible to magnify these telephonic indications very effectively by the use of the vacuum tube and loud speaker, and there may be potentialities of semi-quantitative measurement of leakage sounds along this line. The importance of continuous and reliable service on transmission lines is so great that the central-station industry will do well to consider the early establishment of a research the progress of which can be published and discussed as it goes forward for the benefit of distributors and users of energy.

Unique Mitchell Dam Plant Now in Operation Twelve Weeks









ELECTRICITY has now been generated about three months at Mitchell Dam, the unique hydro-electric station of the Alabama Power Company on the Coosa River. The water was first turned through the wheels on March 26. The plant, which will have an ultimate rating of 120,000 hp. in five units, is unusual in several features, as explained in detail in the June 10, 1922, issue of the ELECTRICAL WORLD. Its waterwheels and generators are separately mounted in concrete islands along the up-stream face of the dam, and water flowing over the spillway, which occupies the entire length of the dam, is utilized to force the discharge of the draft tubes down stream. Thus during high water the back-water elevation is greatly suppressed. Besides, this plant has the distinction of having no generator room, each unit being housed under a small roof, which can be opened for handling equipment with an outside crane. All transformers and switching equipment are mounted outdoors on the deck of the dam. The cost of the plant is said to be no more than for a conventional plant of the same rating. Furthermore, the capacity during high water and the energy output possible per year are in excess of the amounts obtainable in conventional designs.

Progress in Field Testing of Insulators

Importance of Periodical Investigations—Problem of Detecting Conditions Which May Lead to Failure—Results from Practice—Flexibility of Method Pursued

By FRANK C. DOBLE
Doble Engineering Company

THE inherent properties of porcelain insulators of even the best designs now manufactured make the completed unit subject to deterioration. This deterioration may be due to cracks from the unequal expansion of the materials in the insulator unit, to rough handling or shooting, to lightning or power arcs. It may also be caused by leaks due to porosity, although modern manufacturing methods have nearly eliminated this defect. Two field testing problems confront the operating engineer—(1) how to find insulators in stock which warrant rejection before putting them into service, and (2) how to locate insulators in service which have depreciated before they have become too serious a hazard.

Certain general requirements for the solution of the first problem at once call for a more effective method than merely visual inspection in order to show such defects as internal breakage, porosity and so forth. A method employing a voltage stress across the insulator will make possible other indications of deterioration.

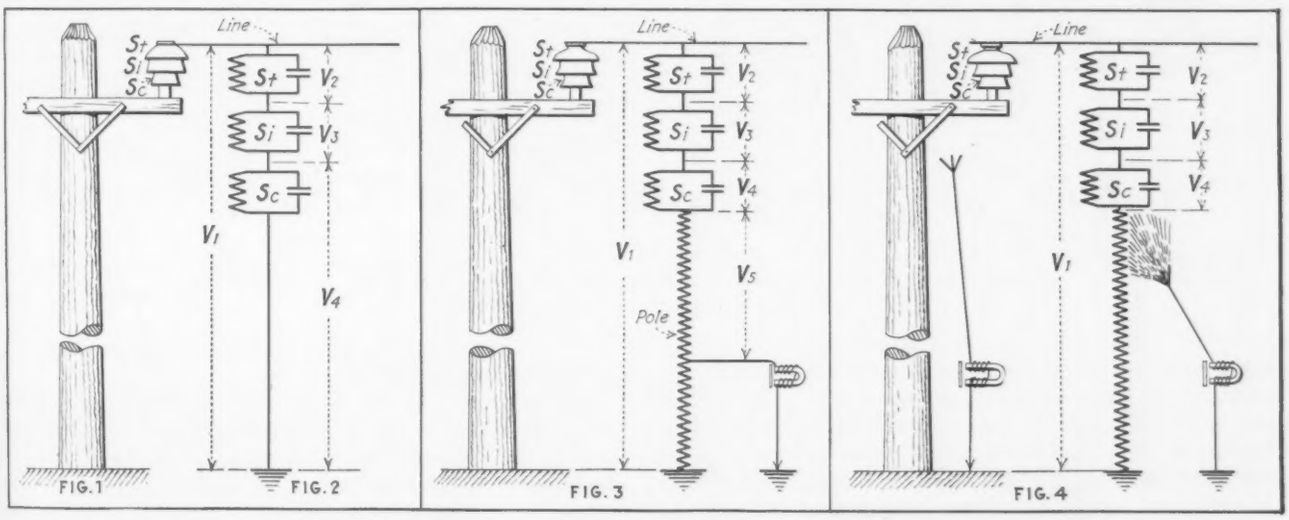
Any method for the solution of either problem must necessarily be simple to operate, definite as to indication and should be applicable to live lines. It should also be capable of indicating defective insulators at predetermined points of deterioration, in order that they may be detected and discarded before installation on the line or detected and removed from service before causing too serious a hazard.

A proper insulator-testing device must first be safe to use under all conditions of insulator deterioration, and it must be capable of indicating defective insulators at predetermined points of deterioration and on widely different types of construction.

From the standpoint of safety the testing device when applied to an insulator must not short-circuit the whole or any part of the insulator, it must not reduce the resistance of the leakage path over any part of the insulator nor raise the voltage on the whole or any part of the insulator, because if any of these things take place on a very bad insulator under test it will fail and cause a short circuit or ground.

As an insulator deteriorates there will be a variation in the leakage or charging current, or in the proportion of the voltage stress division over the insulator, and a device which will give some sensible indication of abnormal variations in this current or voltage stress distribution will show some measure of its deterioration.

Fig. 1 represents a conventional three-shell, pin-type, insulator and Fig. 2 is a diagrammatic representation of the same insulator with each shell represented as a resistance and a capacity in parallel and the three shells in series between line and ground. The three shells of the insulator are named top, intermediate and center, and in the diagram are designated by *St*, *Si* and *Sc* respectively. The total potential V_1 over the insulator is shown as subdivided into the values V_2, V_3 and V_4 over the various shells as a normal condition.



FIGS. 1 AND 2—POTENTIAL DISTRIBUTION OVER PIN-TYPE INSULATOR IN GOOD CONDITION. FIGS. 3 AND 4—POTENTIAL DISTRIBUTION WITH NON-INSULATED TYPES OF TELEPHONIC TESTING EQUIPMENT. VALUE OF INSULATION UNCHANGED

The apparatus which has so far been developed for testing insulators in service on live lines may be generally classified under three types:

1. Non-insulated telephonic type.—Two forms, both of which are adaptable only to non-grounded construction.

2. Short-circuit type.—Two forms, known as metallic short-circuit method for pin-type and suspension-type insulators and spark-gap short-circuit method for pin-type insulators.

3. Insulated telephonic safety type.—Two forms,

known as Doble safety method, type A, for pin insulators, and Doble safety method, type B, for suspension insulators.

The operation of the non-insulated telephonic type of apparatus depends upon the leakage current, and its use is limited to the special condition of a non-grounded support such as a wooden pole, which acts as a very high resistance in series with the insulator, as in Fig. 3. A pair of high-resistance telephone receivers are connected in parallel with a considerable section of the pole, and a part of the leakage current flowing down the pole is shunted through the receivers; or the upper connections may be an arrangement of sharp points to collect energy from lines of stress emanating from the pole or insulator as in Fig. 4. In either case the indication is a comparative one, since a good insulator gives some noise. Great care must be used not to bring either terminal of the circuit too near any live line, since there is a direct metallic connection to the operator. The operating conditions of the line are not changed by these tests, and the test results are limited.

The operation of the short-circuit type of tester depends upon the voltage stresses as distributed over the various shells. The apparatus is applied directly to an insulator. By the metallic short-circuit method the top shell may be short-circuited as shown in Fig. 5, and then the short-circuit broken and an arc drawn from one of the contacts, provided sufficient potential exists across the shell under test. The length or strength of this arc is noted and compared, in the judgment of the operator, with the similar arc given by a known good insulator.

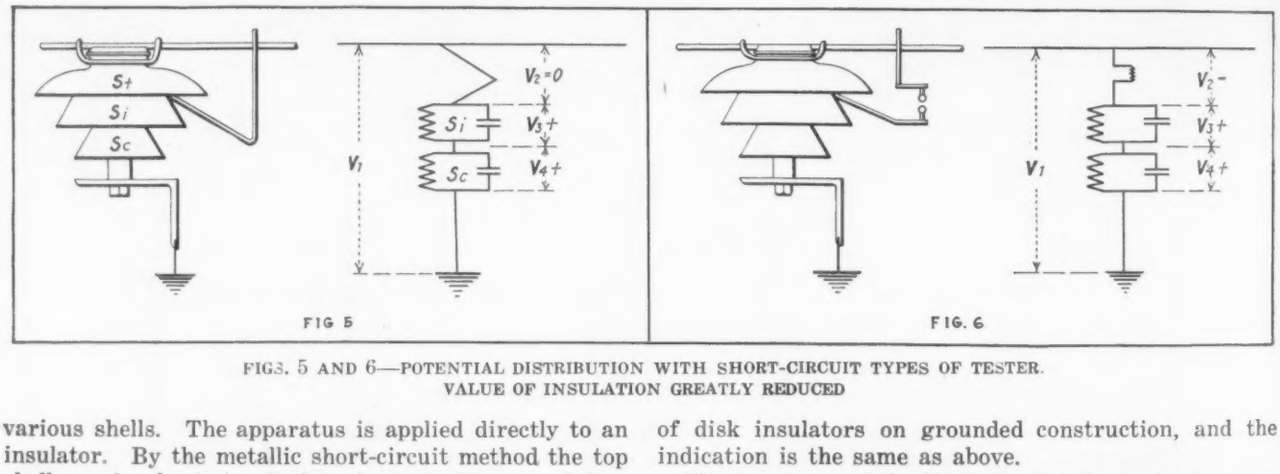
By the spark-gap short-circuit method the top shell may be short-circuited as shown in Fig. 6 with an air gap in series to act as a measure of the voltage. The maximum gap which will be jumped by the voltage across the top shell of a good insulator is found, and the deterioration of other insulators is judged from the lesser gap which the stress across their top shell will jump.

It will be noted from Figs. 5 and 6 that a short-circuit type of tester changes the operating condition of the line by actually removing a part of the insulator under test from service, by virtue of the short circuit. When a short-circuit method is applied to suspension insulators the same condition takes place, in that a portion of the insulator under test is short-circuited and the operating conditions are actually changed.

The operation of the Doble safety method depends upon the voltage stresses as distributed over the various shells of a pin-type insulator with the "type A" tester, or over the units of a suspension string with the "type B" tester.

Fig. 7 diagrams the theory of operation of the "type A" tester when applied to the upper cement of a three-shell insulator in order to test the top shell, as illustrated, for non-grounded type of construction, and Fig. 9 illustrates a similar condition of application on grounded construction of the line. The electrical connections of the "type A" tester consist of an air gap in series with a resonated local circuit and a capacity to ground with one terminal only brought out to a point which may be applied to the insulator under test. A sound is produced in the telephone if the potential above ground at the point of contact is sufficient to jump the gap and charge the telephone circuit, and the length of the gap indicates the value of such potential.

The application of the "type B" tester is shown in Fig 8. It is applied to the terminals of a disk-type insulator so as to test its condition when located in the middle position of a three-disk string. A sound is produced in the tester provided the potential across the disk under test is sufficient to jump the gap and charge the telephone circuit, and the length of the gap is an indication of the value of such potential. Fig. 10 illustrates a similar condition of application to a string of disk insulators on grounded construction, and the indication is the same as above.



FIGS. 5 AND 6—POTENTIAL DISTRIBUTION WITH SHORT-CIRCUIT TYPES OF TESTER. VALUE OF INSULATION GREATLY REDUCED

The two types of the Doble insulated telephonic tester are each based on the same general principle of protection to the operator while listening, but they differ from each other in essential points of construction and application to an insulator under test. The "type A" outfit makes but a single contact with the insulator and is most widely used on pin-type insulators. The "type B" outfit is primarily designed for testing suspension or disk-type insulators.

In the "type A" tester a telephone circuit is inclosed in a case of hard rubber or other insulating material, and one side of this circuit is brought out through an air gap having a micrometer adjustment to a metal point which may be applied to a pin-type insulator. The other side of this circuit is a capacity effect to ground. The metal contact is the only part of the circuit which can be applied directly to the transmission line or live parts of the insulator under test. All other parts of the circuit are surrounded by an insulating medium having a higher dielectric strength than air. The introduction of the apparatus into the field around an insulator does not reduce the resistance of the leakage path over the insulator, and further, on account of the high insulation in the casing of the tester, it will not cause a short circuit or ground even on a very bad insulator.

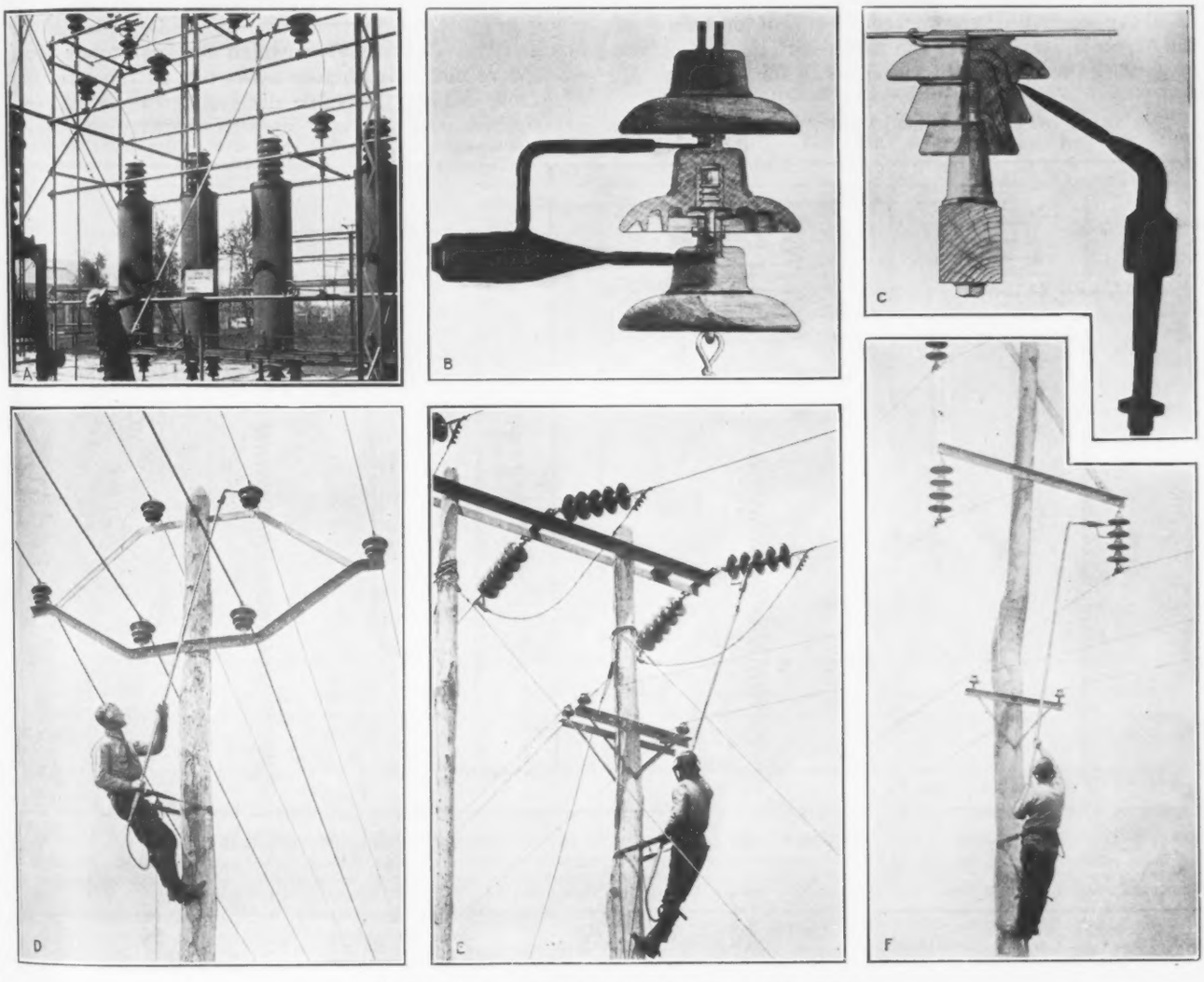
A hollow tube of impregnated wood extends from the rubber case to any desired length, and a flexible rubber

hose connects the far end of this tube to a suitable head device for an operator. A continuous air column extends from the receiver diaphragm in the rubber case through the wooden tube and rubber hose to earpieces, which enable the operator to listen as with a stethoscope. A sound is produced in the telephone when the point is applied to a given part of an insulator, provided that the electrical conditions at this point are greater than some predetermined value. The air column through the insulating tube and the rubber hose conducts the sound to the ear of the operator in the manner of a combination speaking tube and stethoscope, with perfect safety to the operator.

In operation no metallic connection exists between the telephone in the hard-rubber case and the operator. The impregnated wood tube is paraffine-treated for several hours and may be several feet long, depending principally upon the physical limitations of handling it and accurately applying the point to the desired part of the insulator. The rubber hose is made of 70 per cent Para rubber vulcanized like an automobile tire casing. Short sections of metal hose are inserted at either end of the rubber hose for added stiffness where the greatest wear occurs, owing to bending in use. This metal is not objectionable from an electrical safety standpoint when the set is in use, since it is not necessary to insulate the air column above or below the point at which the operator grasps the tube in order to manipulate the apparatus.

There is a very high insulation between the operator's headpiece and the hose coupling to the wood tube, owing to several feet of rubber hose without metal lining—a construction purposely adopted on account of the possible accidental contact of the hose coupling with live parts when the headpiece is in place on an operator while he is climbing up through other wires or working over other live circuits. This point of safety is not intended to encourage carelessness in the operator, but rather to be an added safeguard in the case of an unavoidable slip.

In operation the apparatus may be regarded in the same light as an impregnated switch stick and similar limitations may be put upon its use as regards the



NEW METHODS OF TESTING INSULATORS ON LIVE LINES

Rapid advances in the testing of insulators under operating conditions in the field is indicated by the above illustrations.

A shows the short-circuit, air-gap method, in which the length of the gap across which the voltage stress will pass when a shell is "shorted" is compared with the voltage gap necessary to jump a normal insulator (see Fig. 6).

C shows the application of the Doble insulated telephonic tester to a pin-type insulator, the telephone indications being transmitted to the operator via air column through an insulated stick rubber tubing and ear pieces (see Figs. 7 and 9).

D is a field view of the above insulated telephonic tester as applied to a 25,000-volt, pin-type line forming part of the Boston Edison-New England Power Company interconnection trunk.

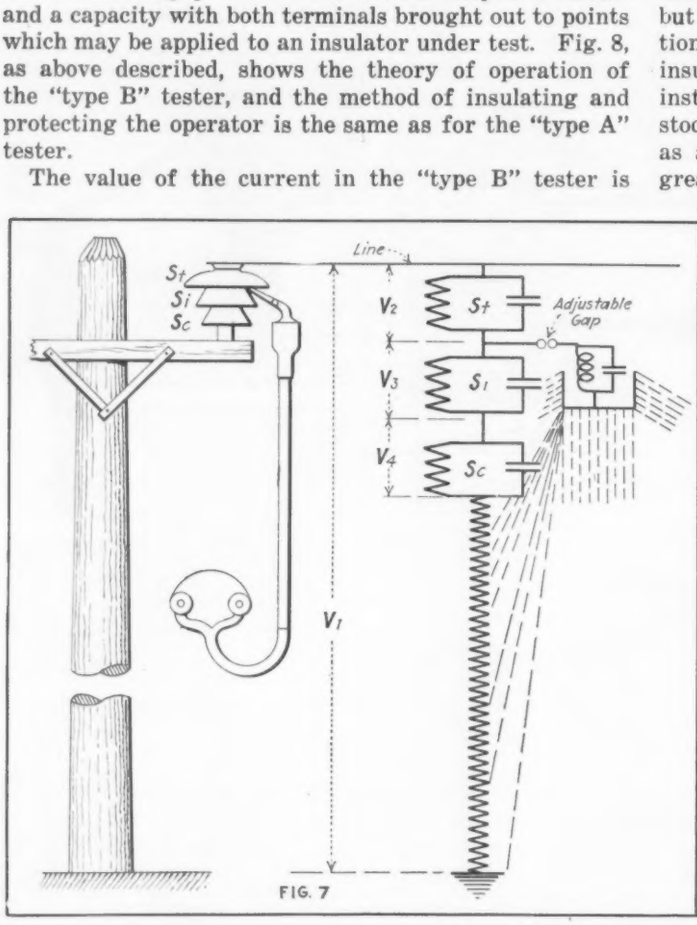
B shows an application of the Doble tester to the disk of a suspension type insulator, with air column transmission of telephonic indications as in B (see Figs. 8 and 10).

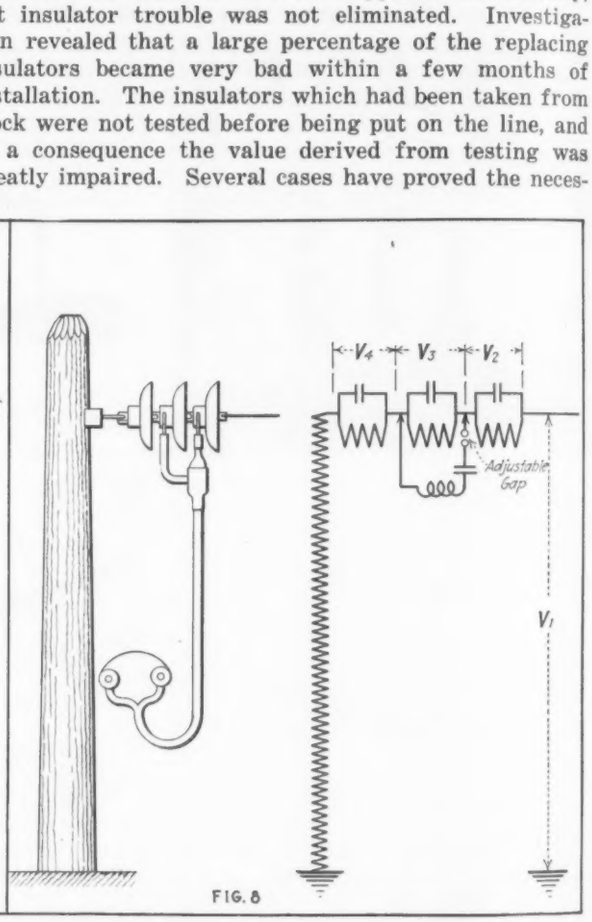
E shows the last-named equipment as applied to a 66,000-volt line equipped with disk-type insulators, in field service, and F shows this equipment as adapted to testing at different angles.

length of tube necessary for a given voltage on account of separation and weather conditions. If grounding the tube at some point beyond the part normally grasped in use is thought to increase the safety of operation, this may be done without detriment to the efficiency of the tester, provided that a reasonable distance is left between the ground connection of the stick or tube and the telephone proper.

The electrical connections of the "type B" tester consist of an air gap *G* in series with a telephone circuit and a capacity with both terminals brought out to points which may be applied to an insulator under test. Fig. 8, as above described, shows the theory of operation of the "type B" tester, and the method of insulating and protecting the operator is the same as for the "type A" tester.

The value of the current in the "type B" tester is less than the charging or leakage current of an insulator under test, even though its condition is normal. This means that the tester in operation is an open circuit in terms of power current since every insulator on the line is leaking to ground at all times more current than passes through the tester even under maximum conditions.





FIGS. 7 AND 8—TESTING PIN AND DISK TYPE INSULATORS ON UNGROUNDED SYSTEMS

Fig. 7—Potential distribution over pin-type insulator with insulated telephonic type of tester and non-grounded type of construction. Value of insulation unchanged.

Fig. 8—Potential distribution over disk-type insulator with insulated telephonic type of tester applied around shell, non-grounded construction. Value of insulation unchanged.

EXAMPLES OF EXPERIENCE IN INSULATOR TESTING

The following examples have been obtained from specific cases of testing:

1. A company operating several miles of 22,000-volt transmission line on fifteen-year-old insulators experienced eleven insulator failures over a period of eleven weeks, or an average of one per week. One test with the "type A" insulated telephonic tester showed about 33⅓ per cent of the insulators to be bad. These bad insulators were replaced by good ones, and with the other two-thirds of old insulators still in service there were no failures during the nine months following, including three months of severe lightning.

2. *Case* 1—*On New Line.*—Tests made on a new 25,000-volt transmission line before putting it into regular service revealed that about 7 per cent of one type of insulators were bad.

Case 2—*Old Line Replacements.*—Tests were made on an entire system with the "type A" tester and several hundred insulators which were unquestionably bad were indicated and removed. The tests appeared satisfactory, but insulator trouble was not eliminated. Investigation revealed that a large percentage of the replacing insulators became very bad within a few months of installation. The insulators which had been taken from stock were not tested before being put on the line, and as a consequence the value derived from testing was greatly impaired. Several cases have proved the necessity for testing stock insulators before putting them in service.

3. *Case* 1.—Check tests on quite a number of three-shell, pin-type insulators were made in the field with the "type A" tester and the spark gap short-circuit method previously described and shown by Fig. 6. Several insulators checked as good or bad with both types of testers. One insulator indicated as follows: "Good" by five consecutive tests with the short-circuit tester; "bad" by five consecutive tests with the "type A" tester. This insulator was removed from service, and even though it was visually perfect, the top shell punctured in air at 21,000 volts when a good insulator should have required about 90,000 volts for puncture.

Case 2.—Tests on a 25,000-volt transmission line of three-disk strings were made with a "type B" tester by a power company's own lineman, to whom the tester was new and unfamiliar. Several insulators were indicated as bad and removed from service. At the test

laboratory all but three of these insulators were also indicated as bad by other tests. The other three insulators by every available test except high potential appeared to be good. Subsequently all three insulators punctured in air before they flashed over, which showed that the "type B" tester will indicate degrees of serious defect which can be detected by no other safe method.

4. *Case* 1.—Tests made on a 66,000-volt transmission line on several hundred pin-type insulators mounted on steel structures indicated about fifty insulators to be defective. Seven samples were picked at random from the fifty noted as defective in order to study them by laboratory test. Some of these showed visual cracks in the top shells, while others were visually perfect as a whole. Under high-potential test certain of these insulators immediately punctured the top shell and flashed the other shells, while other insulators which showed visual cracks appeared to flash over the whole insulator.

The question has been raised whether any danger exists of causing a short circuit in the presence of the operator while applying the "type B" tester to the controlling good disk in a string of suspension insulators. The chances of such trouble are practically nil. To produce a flashover arc in this way the test apparatus would have to be broken down inside without the knowledge of the operator. This is a remote possibility as the normal operation of the test apparatus gives a continuous check upon its condition. There is really no more chance of a flashover from the above cause than there is of a flashover in the face of an operator who has occasion to approach a live line with all outward indications of normal operating conditions upon the circuit.

On low voltages there is a remote possibility of a crack defect which will not change the voltage distribution over a perfectly dry insulator in any measurable amount and yet the crack may be plainly apparent to the

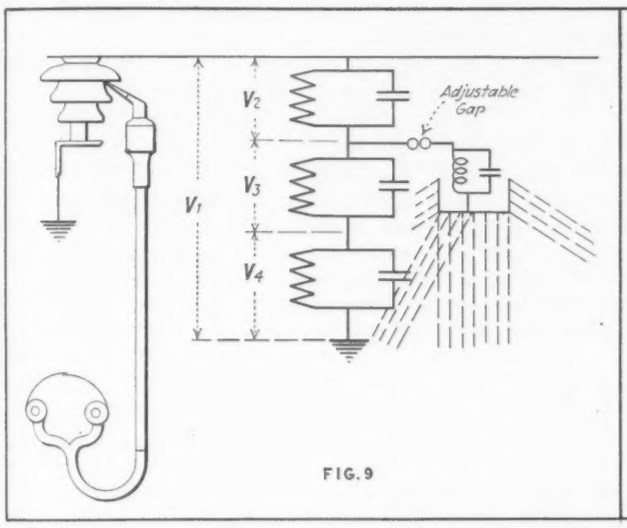


FIG. 9

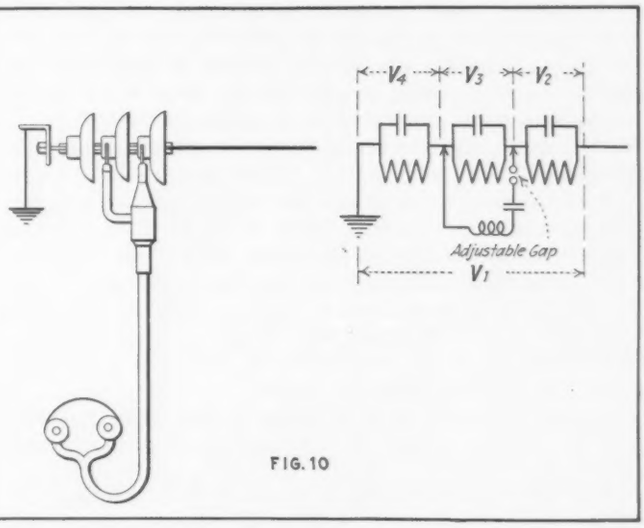


FIG. 10

FIGS. 9 AND 10—TESTING PIN AND DISK TYPE INSULATORS ON GROUNDED SYSTEMS

Fig. 9—Potential distribution over pin-type insulator with insulated telephonic type tester, grounded type of line construction. Value of insulation unchanged.

Fig. 10—Potential distribution over disk-type insulator, grounded type line construction, with insulated type telephonic tester. Value of insulation unchanged.

Owing to the fact that many companies accept their insulators by visual flashover tests, these results appeared to be seriously at fault. Further investigation revealed that the insulators which had cracked top shells and apparently flashed over actually punctured the top shell first and then flashed over. This was proved by taking one of these insulators and breaking out a considerable piece of the top shell, and then two or three inches of the tie wire was exposed directly to the first intermediate shell. With this piece broken out, the insulator flashed over at the same value as previously, namely, the normal flashover value for the intermediate and center shells without the top. This proves that visual flashover without reference to voltage is not an absolute criterion for judging deterioration.

Case 2.—Tests made by a power company on a 25,000-volt transmission line with "type A" tester on 17,000 insulators indicated about 2 per cent as defective. When removed from service many of these insulators were visually perfect and under high potential test apparently flashed over. Further study revealed that every insulator indicated as defective by the "type A" tester was unquestionably bad and that the apparent flashover was in reality the same misleading effect just described.

naked eye. No known testing apparatus will locate such a defect except by impressing a potential on the insulator about normal working value. Any such high-potential method is very dangerous if used on a live line.

CONCLUSIONS

Every transmission-line insulator should be tested in the field before being placed in service and every insulator in service should be tested periodically, say every six months to two years, according to the line voltage, age and condition of the insulators.

Live-line testing is most satisfactory from standpoint of cost and efficiency. It should meet the following safety requirements: Protection to operator from direct shock; protection to insulator under test from short circuit of its parts; reduction in leakage path; potential in excess of normal operating value.

Results in the field show that insulated telephonic testers will indicate defective insulators on live lines, and that some standards for testing must be agreed upon to determine when an insulator is bad enough to warrant its removal from service. This is difficult but essential if uniformity is desired.

Why Electric Heat Treating Is Economical*

Actual Comparisons Show an Economical Field for Application of Electric Heat to Industrial Processes Even with Present-Day Relative Costs of Fuel and Electricity—Energy Cost Is Not the Only Consideration, However

By E. F. COLLINS
Consulting Engineer Industrial Heating Department, General Electric Company

MANY manufacturers, engineers and executives unfamilar with the possible economies of industrial electric heating dismiss it from serious consideration on the theory that it is expensive and impracticable. However, such is not the case. Electric furnaces designed for 1,600 deg. F. operation, when properly constructed and applied, give thermal efficiencies around 80 per cent so that 16 per cent of the B.t.u.'s in coal burned to generate the electrical energy could be effective in heating the metal if the power is generated in a large central station. Furthermore, electric forge furnaces operating around 2,300 deg. F. can utilize 10 to 12 per cent of the B.t.u.'s in the coal used to generate electrical energy, since the efficiency of the furnaces alone is 50 to 60 per cent. These thermal efficiencies compared with 9 per cent for a fuel-fired forge are worth serious consideration. When the electric furnace or oven is used for drawing at lower temperatures its efficiency may easily be above 80 per cent, hence showing still greater economy over the smithy forge than indicated above.

Passing from the smithy forge to the more modern type of furnace, it may be interesting to look at some efficiencies which may be obtained in the consumption of fuel by the direct-burning process—that is, utilizing it direct in the furnace in which the material is to be treated—and, on the other hand, burning it under the central-station boiler and finally heating the furnace in which material is being heat-treated by electric heat properly applied. The accompanying charts illustrate what may be accomplished in this way as between electricity produced by the central station burning coal and the furnace burning oil directly in the chamber in which material is being heat-treated.

Fig. 1 shows the B.t.u. costs for an electric as against an oil-fired furnace for heat treating. The left-hand square represents 20,000 B.t.u. which may be purchased with oil at 7 cents per gallon. With an oil furnace having an efficiency of 16 per cent, which is better than the average, it may be expected to put 3,400 B.t.u. of the 20,000 B.t.u. into the charge. Now, with coal at $5 per ton, the central station may expect to get 1 kw.-hr. from 1.5 lb. of coal, or a coal cost of 0.425 cent. Adding the overhead charges of the central station, there results about 3,840 B.t.u. in electricity for 1 cent. If this electricity be used in the electric furnace with 80 per cent efficiency, there will be utilized in heating the charge 3,400 B.t.u. In other words, with oil costing 7 cents at the burner and coal $5 at the boiler, one just about breaks even on a B.t.u. cost basis with electric heat and with oil when prices as given for coal and oil prevail. The above is for furnace temperatures of about 1,600 deg. F., such as are required for heat-treating steel.

*Based on paper read in Boston before the American Society for Steel Treating.

It is likewise interesting to compare costs for baking enamel at 450 deg. F. in the electric oven and by a process which is at present being promoted, namely, the so-called "indirect-oil" heating scheme. In this "indirect-oil" baking process the oil is burned under or outside a muffle. Through the muffle air is forced and heated to about 800 deg. F. and passed into a japanning oven over the work, so baking it.

In Fig. 2 one square represents the cost of 17,000 B.t.u. when oil is selling for 8 cents per gallon. The efficiency of the oil heater is 75 per cent, and hence 12,800 B.t.u. is sent to the oven in the heated air. The oven efficiency for this method of heating is by test 12 per cent. Hence 1,540 B.t.u. is actually effective in heating the charge at a cost of 1 cent, neglecting the overhead cost of burning the oil. The above cost represents cost of oil at the burner as 8 cents. Fig. 3 shows the relative cost of upkeep of the electric oven as compared with the "indirect-oil" system. Correction must

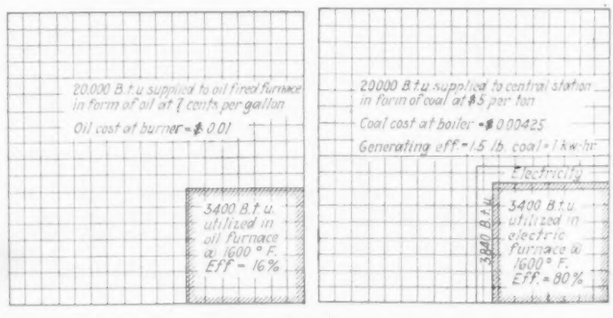

20,000 B.t.u. supplied to oil fired furnace in form of oil at 7 cents per gallon
Oil cost at burner = $ 0.01
3400 B.t.u. utilized in oil furnace at 1600° F. Eff = 16%
20000 B.t.u. supplied to central station in form of coal at $5 per ton
Coal cost at boiler = $ 0.00425
Generating eff = 1.5 lb. coal = 1 kw-hr
Electricity
3840 B.t.u.
3400 B.t.u. utilized in electric furnace at 1600° F. Eff = 80%

Fig. 1

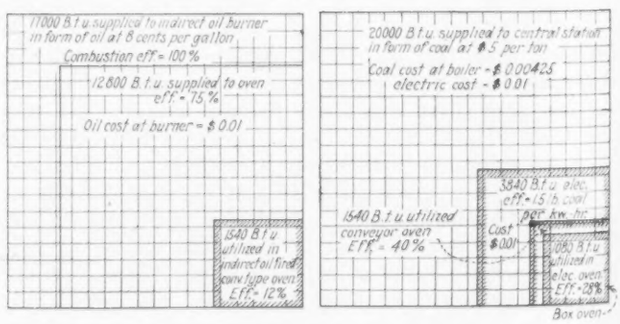

17000 B.t.u. supplied to indirect oil burner in form of oil at 8 cents per gallon
Combustion eff = 100%
12800 B.t.u. supplied to oven eff. = 75%
Oil cost at burner = $ 0.01
1540 B.t.u. utilized in indirect oil fired conv. type oven Eff = 12%
20000 B.t.u. supplied to central station in form of coal at $5 per ton
Coal cost at boiler = $ 0.00425
electric cost = $ 0.01
3840 B.t.u. elec. eff = 1.5 lb. coal
1540 B.t.u. utilized conveyor oven Eff = 40%
Cost $ 0.01
1060 B.t.u. utilized in elec. oven Eff = 28%
Box oven

Fig. 2

FIGS. 1 AND 2—B.T.U. COSTS OF HEAT TREATING, ELECTRIC VERSUS OIL-FIRED FURNACE

be made for this overhead to get comparative costs of electricity and of oil heat for baking.

Referring again to Fig. 2, the right-hand square represents 20,000 B.t.u. in coal at the boiler of the central station, costing 0.425 cent with coal at $5 per ton. Assuming an average overhead for the central station, the cost of electricity may be taken at 1 cent per kilowatt-hour, or 3,840 B.t.u. for 1 cent. Using this 3,840 B.t.u.

in the electric japanning oven, one actually utilizes 1,540 B.t.u. in baking the charge at a cost for power of 1 cent. Hence on a B.t.u. basis it may be expected that one will break even on cost when the above conditions exist. The above has been said to show why the actual test results recorded in Fig. 3 are so greatly different from the sixteen-to-one rates arrived at by the offhand reasoning mentioned above.

It will be seen that the actual test results of Fig. 3 are to be expected after analyzing the problem as per Figs. 1, 2 and 3. For in Fig. 3 oil costing 8 cents at the burner gives the same over-all cost on a B.t.u. basis as electricity at 1 cent per kilowatt-hour gives for baking japan at 450 deg. F.

It must not be forgotten that the efficient generation and utilization of a heat unit is usually quite different for the electric and the fuel-fired furnace under starting conditions, and it must also be remembered that, even with perfect combustion of fuel, which seldom exists, a large percentage of generated heat leaves the metallurgical furnace as flue gas without doing useful work. In practice 50 per cent excess air is not unusual, and this increases the flue-gas loss and lowers the combustion efficiency to a very remarkable degree as one passes from low to high temperatures.

Over-All Cost and Not Heating Cost Is Important Factor

While these illustrations show that there is a field for electric heat with present-day relative costs as between fuel and electric heat, it is not intended here to contend that electric heat under all conditions and in all places is suitable to replace fuel heating. However, it is a matter of no distant time when the use of electric heat for important thermal and metallurgical processes will be adopted with no more hesitation than now occurs when the householder decides in favor of the electric light for his home as against the gas lamp, even though the cost of energy consumed be greater than that of gas.

It matters little what the cost per B.t.u. for a given heating process is so long as the over-all cost of manufacture, quality of product and working conditions are unaffected. If process conditions, quality of product and production were increased by using electric heat, one would be justified in accepting generally a higher B.t.u. cost for the sake of gaining these advantages. Fortunately for electric heat, many such advantages are inherent in its use. These will, of course, vary with the application and local conditions. Hence a study of all the factors involved should be made when deciding whether electric heat or fuel heat should be used. That these factors are of extreme importance is proved by the very fact that industrial electric heating is rapidly increasing in the face of the widespread misunderstanding previously noted.

Many times a single factor contributes savings sufficient to overbalance any possible higher cost of electrical energy. In some extraordinary cases a rate of 75 cents per kilowatt-hour would still leave the electrically heated equipment superior to the fuel-fired equipment.

Perfect Heat Generation

The cost of burning fuels varies widely, depending upon the amount of air admitted to the furnace and the resultant combustion; for example, the cost of city gas per 100,000 B.t.u. effective rises to double its value with an increase of 50 per cent in air, and such excess percentage of air is by no means rare. Fuel oil likewise increases its cost roughly four times at the same temperature (2,800 deg. F.) and the same excess of air (50 per cent). Hence it is seen to how great an extent the economic operation of the fuel furnace is in the hands of the operator. This handicap does not exist with the electric furnace, where the ratio of conversion from power to heat is 100 per cent perfect and the operator cannot affect this efficiency of conversion.

A brief outline and summary of some of the more

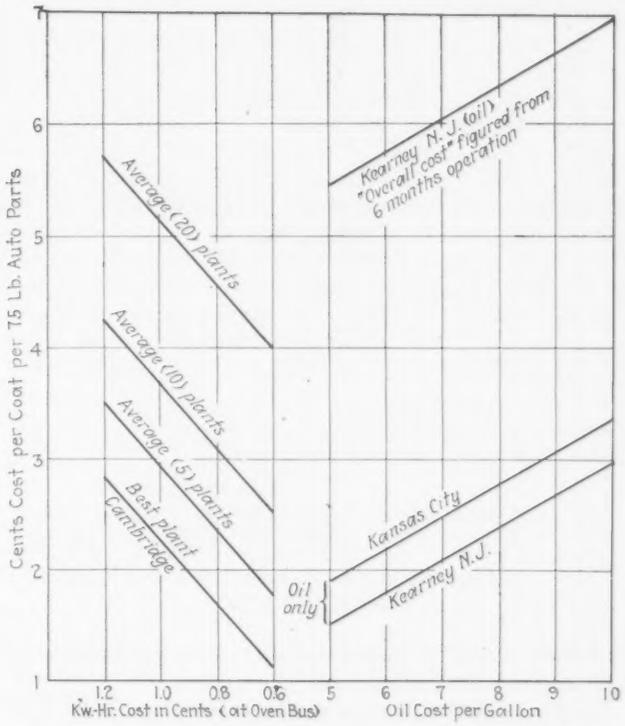

Cents Cost per Coat per 75 Lb. Auto Parts
Kearney N.J. (oil) "Overall cost" figured from 6 months operation
Average (20) plants
Average (10) plants
Average (5) plants
Best plant Cambridge
Kansas City
Kearney N.J.
Oil only
Kw-Hr. Cost in Cents (at Oven Bus)
Oil Cost per Gallon

FIG. 3—COMPARISON OF UNIT PRODUCTION EXPENSES WITH ELECTRIC AND OIL FURNACES

important features of electric heating which distinguish it from fuel-fired equipment follows:

1. *Heat Generation:*
   (a) Released at points to give uniform or non-uniform temperature.
   (b) Heat generation balanced against heat absorption.
   (c) Heat generated at or near potential of heating chamber.
   (d) Generated in inactive or dead atmosphere; no contamination of charge. Heating chamber may be a vacuum or under heavy pressure. Artificial atmosphere possible, as hydrogen gas, nitrogen gas and non-combustion gases.
2. *Heat Conservation Resulting in High Thermal Efficiency:*
   (a) High heat lagging, no local high temperatures.
   (b) Small heating chamber and no combustion chamber.
   (c) No hot gases leaving furnace, save for ventilation when necessary.
   (d) Automatic control of temperature so that supply balances demand.
3. *Method of Electric Heat Transmission and Delivery to Charge:*
   (a) Convection of liquids and gases (natural).
   (b) Circulation of liquids and gases (forced).
   (c) Radiation and convection in air.
   (d) Direct radiation to work.
   (e) Direct and reflected radiation to work.
   (f) Heat generated directly in charge by current flowing through it.
   (g) Complete heat saturation of charge without surface overheating, due to perfect automatic heat control.

Many successful working installations of electric heat exist today, and it is predicted that many more industrial processes will be improved and made more economically productive by its application.

A considerable demand comes from manufacturers of automobile parts, such as gears, crankshafts, bearings, axles, etc., which are produced in large quantities and all of which require heat treatment. Many tons of steel are heat-treated each day; therefore the demand for furnaces of large productive capacity and high efficiency. Electric furnaces have long been recognized as ideal for this purpose, but until the last few years they have not been available in such size and of such rugged design

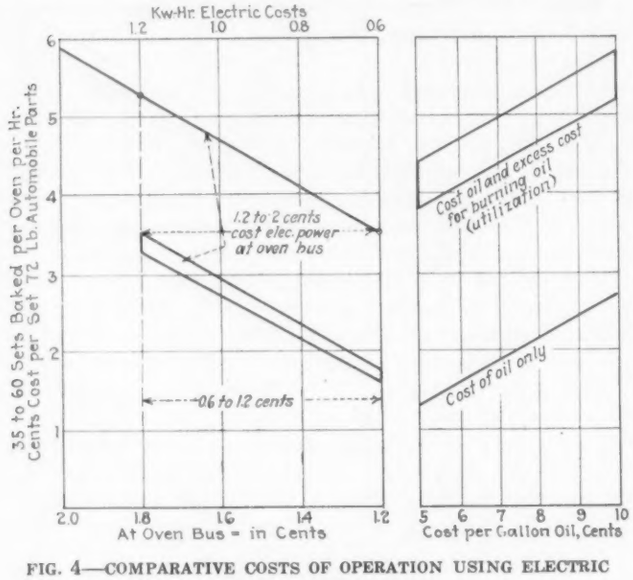

Kw-Hr. Electric Costs
1.2
1.0
0.8
0.6
35 to 60 Sets Baked per Oven per Hr.
Cents Cost per Set 72 Lb. Automobile Parts
1.2 to 2 cents cost elec. power at oven bus
.06 to .12 cents
Cost oil and excess cost for burning oil (utilization)
Cost of oil only
At Oven Bus = in Cents
Cost per Gallon Oil, Cents

FIG. 4—COMPARATIVE COSTS OF OPERATION USING ELECTRIC AND OIL FURNACES

that they could be considered for carrying unassisted their regular production load.

Several manufacturers now appreciate the possibilities of the industrial electric heating field and are making installations at an increasing rate. Equipment is available in practically all capacities for temperatures up to and including 1,800 deg. F. and suitable for many industrial processes.

A type of metallic resistor furnace entered the industrial field in 1917 and 1918, and its use has been attended with unusual success in regular manufacturing production. It was first tested under the rigorous conditions attending gun making in war time, and the results produced were phenomenal.

A basic idea incorporated in the design is the location of the resistor ribbon, unmuffled, in the open heating chamber so that it can directly radiate the heat generated within it.

These ribbons are very rugged mechanically. They are sometimes as much as 1½ in. wide by ⅛ in. thick and are formed into loops. They are supported on refractory insulating members projecting from the walls of the heating chamber, the body portion of the support being embedded in the wall.

The resistor is thus free to deliver its heat by radiation to the charge without the necessity of first forcing the heat through the walls of a muffle, as has been the practice in most metal resistance furnaces heretofore constructed.

In order to force heat through a muffle at high rate and insure rapid heating of the charge, a high temperature gradient and therefore high resistor temperature are necessary. Hence the unmuffled furnace has inherently a lower temperature resistor, produces quicker heating and is much less sluggish in point of temperature regulation than the muffled or screened furnace doing the same work. The unmuffled furnace uses direct and reflected radiant heat.

There are many small installations the importance of which to many shops cannot be overlooked. There is a large growing demand for small self-contained tool-room ovens and furnaces for tempering and hardening tools, cutters, etc.

ADVANTAGES OF ELECTRIC FURNACES

The electric furnace is suited to any heating requirements where the charge does not require that more than 1,800 deg. F. be available. Some of its advantages over fuel-fired unmuffled furnaces are as follows: (1) Radiant heat; (2) satisfactory heat distribution; (3) automatic control of temperatures if desired; (4) small amount of heat given off to the room; (5) no products of combustion or obnoxious gases given off to heating chamber or room; (6) ratio of heat generation to heat absorption by charge correctly maintained; (7) uniform and complete penetration of heat through charge without overheating of corners, fins or surfaces; (8) ability to repeat desired heat cycles, giving uniformity of product; (9) a reduction, generally, in labor; (10) a better over-all economy and the production of higher quality product at the same or slightly higher cost and often of the same quality at a lesser over-all cost.

The accompanying table shows what may be done with the electric furnace in moderate scale operations. The time required to heat these charges was five and one-half to six hours, and the maximum diameter of forgings was 16½ in. The furnaces were 24 ft. high by 6 ft. diameter inside dimensions, the connected load being 400 kw. each. The ultimate or minimum radiation from test was found to be 70 kw. The predicted radiation from design was 75 kw., which is a satisfactorily close agreement.

The actual operating results for four furnaces for the month of October, 1918, when production was at the maximum rate, including both hardening at 1,450 deg. F. and drawing at 1,150 deg. F., was $2.76 per ton, based on the power rate of $0.0085 per kilowatt-hour.

The specifications for drawing did not allow the charge to enter a furnace at full drawing temperature. It was therefore necessary to cool the furnace somewhat and then raise the temperature of furnace as well as charge. It was also required that the charge be held at the drawing temperature for several hours. This of course did not allow of the highest efficiency in pounds of metal heated per kilowatt-hour.

If work at 250 deg. F. to be drawn at 1,100 deg. F. enters a furnace at 1,100 deg. F., a yield of approximately 24 lb. per kilowatt-hour would be realized. This

RESULTS OF TESTS RUN ON AN ELECTRIC FURNACE INSTALLATION INVOLVING THE METALLIC TYPE OF FURNACE

Heating to 1,450 deg. F. Furnaces hot when charged. Furnaces 6 ft. in diameter by 24 ft. high; voltage, 440, 60 cycles, capacity 400 kw.

Charge	Total Weight, Including Holding Fixtures, Lb.	Energy, in Kw.-Hr.
Twelve 3-in. gun tubes	21,900	1,874
Seven 4-in. gun tubes	22,300	1,880
Three 4-in. jackets	21,700	2,088
Total	65,900	5,842
Average pounds per kw.-hr. (65,900 ÷ 5,842) =		11.25
Kw.-hr. per ton (2,000 ÷ 11.25) =		173
Energy cost per ton at $0.0085 per kw.-hr. =		$1.52

would give 2,000 ÷ 24 = 84 kw.-hr. per ton for drawing to 1,100 deg. Fahrenheit.

Therefore the over-all operation required: To harden, 178 kw.-hr per ton for heating to 1,450 deg. F.; to draw, 84 kw.-hr. per ton for heating to 1,100 deg. F., making a total of 262 kw.-hr. per ton.

The cost of $0.0085 per kilowatt-hour is $2.23 per ton. The cost of $2.76 per ton actually achieved during the month of October, 1918, indicates that the furnaces performed exceptionally well.

It is not to be inferred that electric heat is without a competitor in all places and under all conditions. There are, however, a very great number of applications which may be carried out electrically with advantage. These applications in various processes occur with so great frequency that it behooves the user of furnaces to question his engineer thoroughly concerning the possibilities of electric heating before revamping existing installations or adding new heating equipment which employs fuel-fired heating methods.

Increased Activity During April

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate another record operation within the industry during April. Activity in the building trades continues to characterize April business as it did that of March, and pig-iron production, generally regarded as the most accurate single indicator of productive activities, made a new high record in that month, exceeding the previous record production reported during March.

The basic data upon which the "ELECTRICAL WORLD Barometer" is based indicate an increase of 3.2 points on the barometer scale as compared with March activities. During this interval the industry has grown 1.5 points, leaving a net increase in activity of 1.7 points on the barometer scale as compared with March. The electrical industry, as a whole, was operating in April at 29.6 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In March it was operating at 27.9 points or per cent above the point of normal demand.

Large Use of Diesel Engines by Arizona Mining Company

Twenty-four, Aggregating 33,000 Hp., on Properties of Phelps-Dodge Corporation, Show Good Operating Economy

BY C. LEGRAND
Consulting Engineer Phelps-Dodge Corporation, Douglas, Ariz.

DIESEL engines are comparatively new in this country and while they may not be regarded as entirely past the experimental stage, still at the same time they are being successfully operated in many large plants. One of the largest single users of Diesel engines is the Phelps-Dodge Corporation, which employs them in its various mining properties in Arizona and New Mexico. So satisfactory has been this company's experience with Diesel engines that early last year a large part of the power load of the Bisbee district was taken over by a battery of these engines in the power plant near the site of the new concentrating mill.

At the present time there are five installations, as follows:

Tyrone.—Four five-cylinder, 1,250-hp. engines, direct-connected to 60-cycle, three-phase, 850-kw. generators; two three-cylinder, 750-hp. engines, direct-connected to 3,700-cu.ft., 95-lb. air compressors.

Morenci.—Three five-cylinder, 1,250-hp. engines, direct-connected to 60-cycle, two-phase, 850-kw. generators; one five-cylinder, 1,250-hp. engine, direct connected to a 6,400-cu.ft., 100-lb. air compressor.

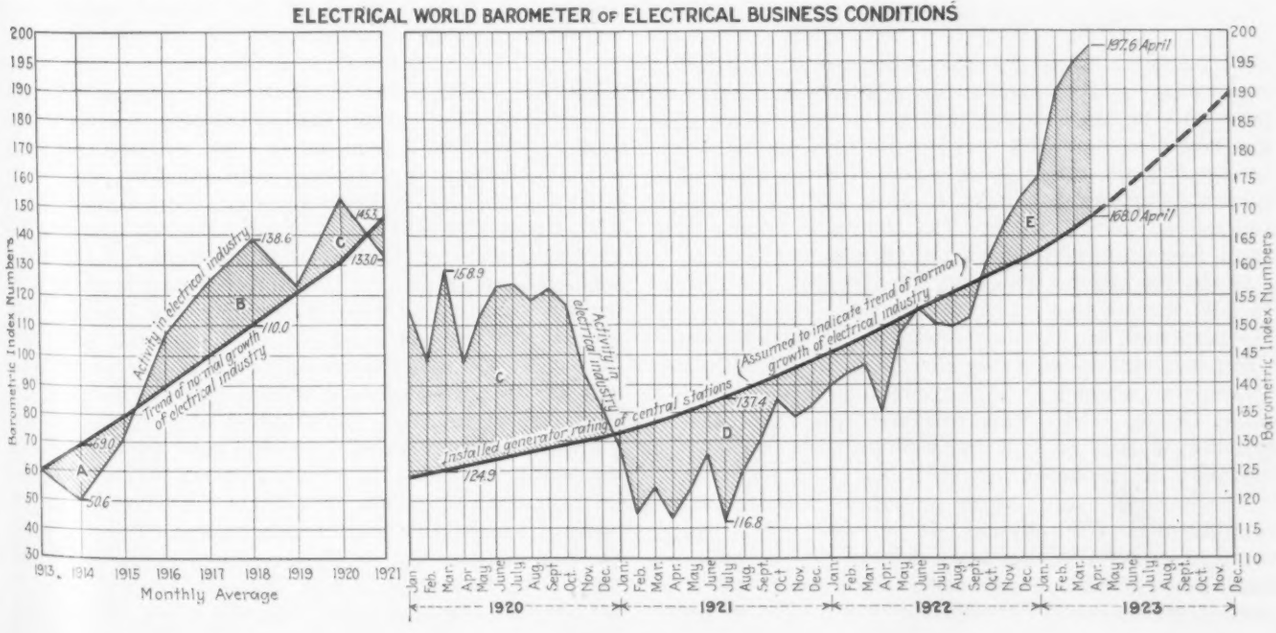
Nacozari.—Two four-cylinder, 2,000-hp. engines, direct-connected to 60-cycle, three-phase, 1,500-kw. generators; four five-cylinder, 1,250-hp. engines, direct-connected to 60-cycle, three-phase, 850-kw. generators; two three-cylinder, 750-hp. engines, direct-connected to 4,000-cu.ft., 95-lb. air compressors.

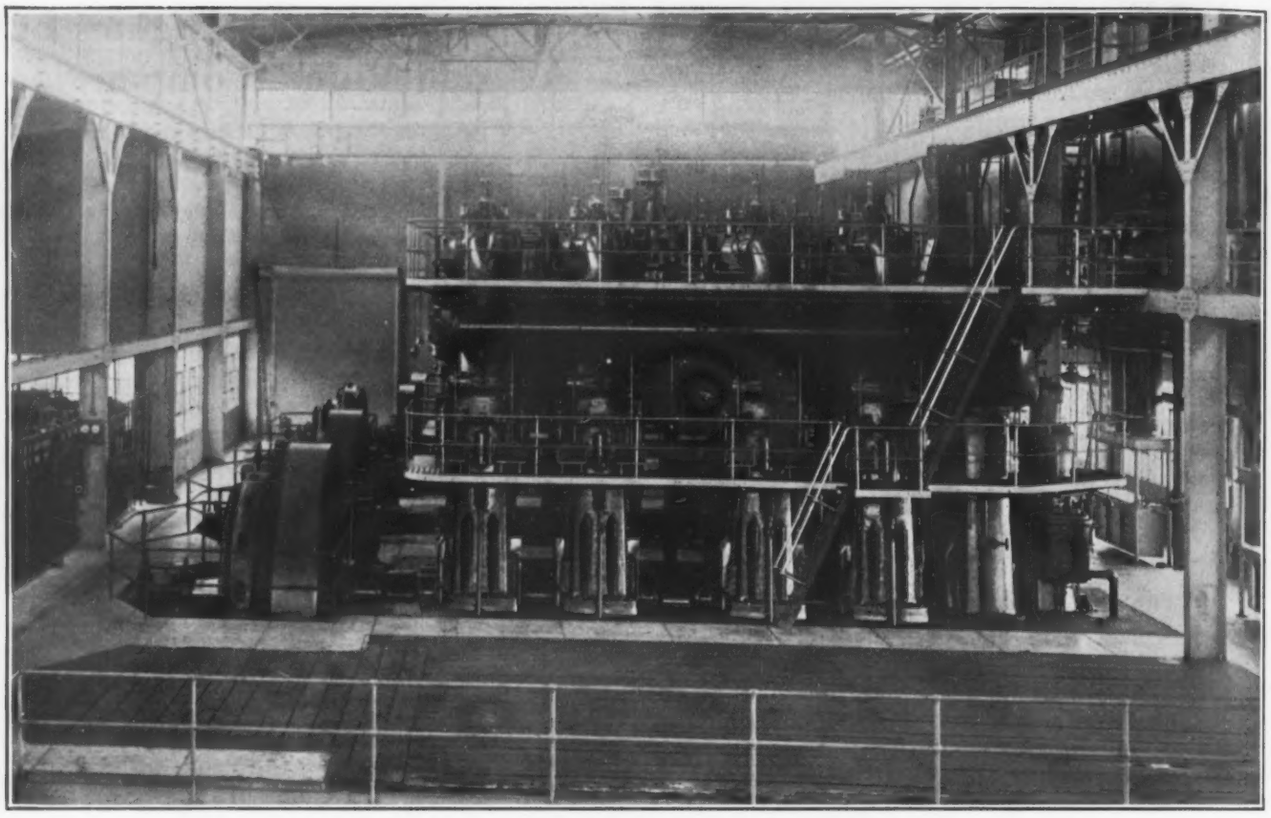
Bisbee.—Two four-cylinder, 2,000-hp. engines, direct-connected to 60-cycle, three-phase, 1,500-kw. generators; two five-cylinder, 1,250-hp. engines, direct-connected to 60-cycle, three-phase, 850-kw. generators.

Globe.—Two five-cylinder, 1,250-hp. engines, direct-connected to 60-cycle, three-phase, 850-kw. generators.

These ratings are for sea-level conditions, and the actual power is slightly reduced at the elevations where the engines are used, which vary from 3,500 ft. to 6,000 ft.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS





DIESEL ENGINES AT THE POWER PLANT OF THE PHELPS-DODGE CORPORATION, BISBEE, ARIZ.

A double system of fuel-oil pipe is used, one supply for starting oil, which has to remain fluid at the lowest temperature liable to be reached in the power plant, and the other for running oil, which can be any oil that will be fluid at the temperature to which it is practicable to heat it. The piping for both oil systems is arranged with an internal heating pipe through which hot water is circulated to heat the fuel oil, and by using the discharge water from one of the exhaust-pipe cooling jackets there is no difficulty in keeping the oil at 140 deg. F. when the engine is operating at one-half load or over and the piping is properly insulated.

Each Unit Is Self-Contained

Each engine drives its scavenging pump and a high-pressure air compressor for fuel injection and is a complete unit in itself except that the cooling water goes to a common pump and is repumped to a cooling tower by one or more pumps independent of the engine. The 250-hp. cylinders have 20¾-in. bore and 26-in. stroke and operate at 180 r.p.m. The 500-hp. cylinders have 28-in. bore and 44-in. stroke and operate at 120 r.p.m.

Since the plants were put in operation California 14 deg. Baumé fuel oil or Mexican 14 deg. Baumé oil has been used for running oil except for a short period when Mexican oil deliveries were stopped. The Mexican oil contains as much as 4½ per cent sulphur and averages about 3¾ per cent. This increases the difficulties of cylinder lubrication and the maintenance cost of the cylinders and piston rings.

The cooling water has an important bearing on the running costs of the engines. If the water carries scale-forming impurities, the scale formed in the cylinder heads and pistons increases considerably the cracking of these parts, not only through the heat-insulating properties of the scale but also by the loose scale plugging water passages and stopping the circulation of water.

Fuel Economy

The fuel economy of the engines is good. Including the exciter losses for the generator, a 1,250-hp. engine delivers a kilowatt-hour at the switchboard with a consumption of 0.69 lb. of fuel oil at loads between 600 kw. and 700 kw. The 2,000-hp. engines use 0.67 lb. of fuel oil per kilowatt-hour at loads between 1,200 kw. and 1,500 kw. On the basis of 14 deg. Baumé Mexican fuel oil averaging 18,500 B.t.u., which was used in these engines, the fuel economy of the 1,250-hp. engines is 12,800 B.t.u. per kilowatt-hour, and on the 2,000-hp. engines it is 12,400 B.t.u. per kilowatt-hour. The power required to operate the auxiliaries of the plant such as water-circulating pumps, fuel-oil-handling pumps, lighting, etc., is from 2 per cent to 5 per cent of the total output according to the local conditions.

In practice the fuel consumption is from 5 per cent to 20 per cent higher than shown on test runs for the load corresponding to average load on the engines, depending upon the load factor on the engines and the plant and on the number of times the engines are stopped and started. For example, at Globe during the first five months of last year the average load per engine running was 587 kw.; the peak load carried exceeded 900 kw. per engine, and the fuel consumption was 0.763 lb. per kilowatt-hour generated. In this case the test curve showed a consumption of only 0.695 lb. of oil per kilowatt-hour for a load of 587 kw. At Morenci, after making proper allowance for excitation of generators, the fuel consumption in the same period was 0.795 lb. per kilowatt-hour, generated with an average load of 511 kw. per engine running, the test curve showed 0.72

lb. per kilowatt-hour. At Tyrone, with a very steady load, but where one engine is running only eleven hours per day, the fuel consumption is 1.25 lb. per kilowatt-hour for an average load of 236 kw., the test curve showing 1.04 lb. for this load.

Operating Costs

The cost of power obtained from these plants is encouraging and justifies the use of the Diesel engine where fuel is expensive and the load on the plant does not exceed 5,000 kw. The maintenance costs of these Diesel plants is high, but they were started at a time when all costs were high. It has been necessary to train operating crews, as none were available, and the cost of this training is reflected in the maintenance costs.

A Diesel plant reaches its average maintenance cost quickly, probably in about three years, while steam plants do not reach their average condition for about fifteen years. In making comparisons between the two types of plants this point must not be overlooked, nor the fact that the Diesel plant is comparable to a complete steam plant, including condensers, boilers, economizers, etc. There is no doubt that with more experience, with a greater supply of trained operating labor, and with the cost of repair material coming down, maintenance costs will be reduced.

The operating costs for the first five months of last year at Globe and Morenci, which are the only two plants running under a fair load condition, and at Tyrone, which shows a non-producing plant running under very unfavorable conditions, are as follows:

Globe.—Total cost per kilowatt-hour distributed, $0.00878, of which operating labor is 17 per cent and fuel oil 69 per cent.

Morenci.—Total cost per kilowatt-hour distributed, $0.00877, of which operating labor is 18 per cent and fuel oil 60 per cent.

Tyrone.—Total cost per kilowatt-hour distributed, $0.01968, of which operating labor is 41 per cent and fuel oil 47 per cent.

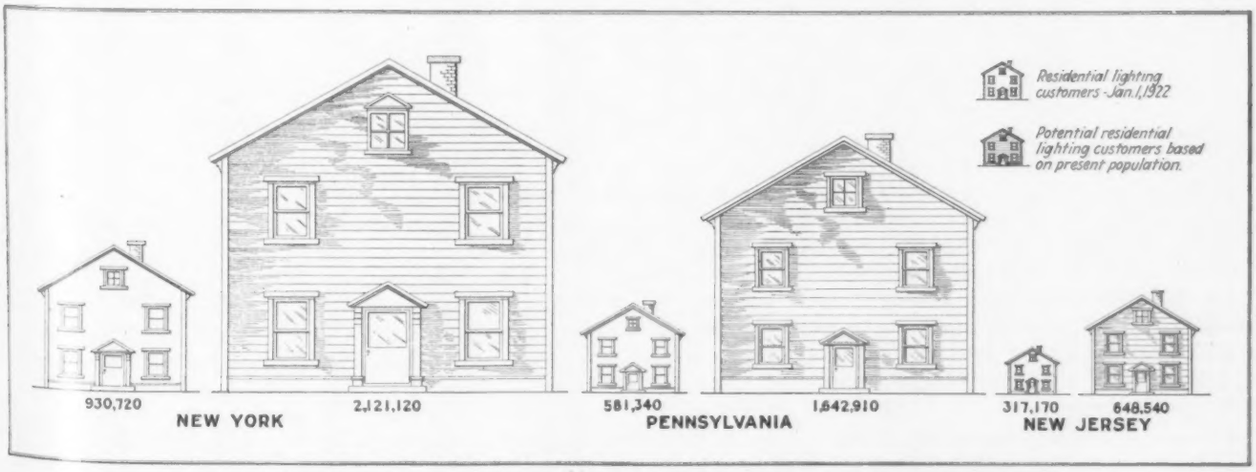
These costs include no taxes or general overhead expense, but all supplies and labor include the overhead expense of supply and mechanical departments. They are per kilowatt-hour available outside the power house for distribution to power users. They are low as regards repairs, which, at present prices of repair materials and taken over a sufficiently long period of time to cover major periodical repairs, would probably be increased $0.001 per kilowatt-hour distributed from the switchboard.

Almost Six Million Potential Customers in Middle Atlantic States

"Electrical World" Estimate by Counties of Present and Possible Future Consumers of Electricity in the Middle Atlantic States Indicates that There Are More than Two and One-half Million Homes in This Section Yet to Be Electrified

NEW YORK, New Jersey and Pennsylvania, comprising what is commonly termed the Middle Atlantic Section of the country, present perhaps the most concentrated field for the future growth of the electric light and power industry to be found in this country or in the world. In 1920 this section, comprising only 3.4 per cent of the total area of the United States, had a population of 22,261,144, or 21.1 per cent of the total population. This gave the section a population of 222.6 persons per square mile, or double that of any other section. Almost three-quarters of these people live in cities and towns, and the section contains seven cities with a population in excess of 250,000.

The distribution of the present number and the potential number of central-station customers among the various counties of these three states is given in the accompanying tabulation. This study is based upon



THE LARGER CITIES OF THE MIDDLE ATLANTIC STATES OFFER A LARGE FIELD FOR THE SUBSTITUTION OF ELECTRIC LIGHT FOR GAS LIGHT IN DWELLINGS

Present and Potential Central-Station Customers in the Middle Atlantic States by Counties

State and County	Population (Census of 1920)			Domestic Lighting Customers		Commercial Lighting Customers		Industrial Power Customers	
	Total	Urban*	Rural	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)
NEW YORK	10,385,222	8,890,049	1,495,173	930,720	2,121,120	261,050	560,900	33,890	65,810
Albany	186,106	159,908	26,198	19,420	43,020	3,410	7,540	550	860
Allegany	36,842	9,786	27,058	2,460	7,050	280	800	60	120
Bronx	732,016	732,016	0	62,800	166,300	8,780	17,600	1,390	4,400
Broome	113,610	93,908	19,702	11,770	25,960	2,070	4,560	170	360
Cattaraugus	71,323	39,659	31,664	6,220	14,980	960	2,320	130	310
Cayuga	65,221	39,937	25,284	5,840	13,930	920	2,190	140	400
Chautauqua	115,348	77,409	37,939	11,300	26,110	1,810	4,180	300	660
Chemung	65,872	51,659	14,213	13,500	15,340	500	2,540	400	600
Chenango	34,969	14,480	20,489	2,600	7,130	330	910	90	180
Clinton	43,898	13,749	30,149	3,000	6,660	500	960	100	300
Columbia	38,930	17,675	21,255	3,180	7,920	480	1,200	80	160
Cortland	29,625	17,761	11,864	2,700	6,650	380	930	40	190
Delaware	42,774	9,263	33,511	2,610	7,650	320	940	80	160
Dutchess	91,747	54,356	37,391	6,200	18,500	1,600	2,500	140	300
Erie	634,688	572,729	61,959	93,000	150,000	17,000	26,550	4,000	7,000
Essex	31,871	11,752	20,119	2,210	5,780	340	890	30	60
Franklin	43,541	18,311	25,230	2,890	7,450	480	1,240	40	80
Fulton	44,927	34,173	10,754	5,080	11,420	770	1,730	270	560
Genesee	37,976	19,166	18,810	3,040	7,580	460	1,150	50	120
Greene	25,796	8,693	17,103	1,920	5,180	240	650	50	100
Hamilton	3,970	0	3,970	90	460	10	50	10	20
Herkimer	64,962	44,216	20,746	8,590	10,850	1,210	1,550	310	650
Jefferson	82,250	43,338	38,912	9,410	12,470	1,750	2,300	270	360
Kings	2,018,356	2,018,356	0	171,400	453,500	43,440	115,000	6,880	13,600
Lewis	23,704	3,127	20,577	1,420	4,130	180	520	60	120
Livingston	36,830	15,006	21,824	2,540	6,710	390	1,030	480	960
Madison	39,535	17,724	21,811	3,350	8,480	460	1,170	60	120
Monroe	352,034	311,055	40,979	35,430	78,360	6,660	14,750	1,250	2,400
Montgomery	57,928	42,363	15,565	5,590	12,620	980	2,210	180	310
Nassau	126,120	77,205	48,915	9,840	23,790	1,700	4,100	130	260
New York	2,284,103	2,284,103	0	131,000	400,000	115,000	240,000	10,000	16,000
Niagara	118,705	92,779	25,926	11,180	24,990	2,070	4,620	520	710
Oneida	182,833	138,163	44,670	16,610	37,670	3,020	6,850	380	960
Onondaga	241,465	196,309	45,156	32,260	8,500	5,770	7,500	640	1,900
Ontario	52,652	28,698	23,954	4,340	10,760	660	1,640	130	200
Orange	119,844	70,296	49,548	10,080	24,060	1,680	4,010	300	400
Orleans	28,619	12,319	16,300	2,410	6,010	340	850	60	120
Oswego	71,045	41,647	29,398	6,170	15,020	950	2,320	70	380
Otsego	46,200	18,072	28,128	3,650	9,710	460	1,230	60	120
Putnam	10,802	1,433	9,369	690	1,960	90	260	10	20
Queens	469,042	469,042	0	70,000	110,000	9,250	14,500	1,490	3,760
Rensselaer	113,129	90,947	22,182	11,980	26,630	2,010	4,470	150	480
Richmond	116,531	116,531	0	9,000	24,000	1,640	4,400	260	700
Rockland	45,548	26,042	19,506	4,850	7,990	1,780	2,970	300	460
St. Lawrence	88,121	34,793	53,328	5,890	16,410	1,000	2,780	110	230
Saratoga	60,029	35,046	24,983	5,120	12,450	800	1,950	70	140
Schenectady	109,363	88,723	20,640	10,440	23,250	1,870	4,160	120	240
Schoharie	21,303	5,195	16,108	1,610	3,580	160	360	30	60
Schuyler	13,098	1,560	11,538	620	2,210	50	180	10	20
Seneca	24,735	10,198	14,537	1,680	4,510	240	640	30	60
Steuben	80,627	45,579	35,048	7,010	17,250	1,030	2,540	130	340
Suffolk	110,246	54,351	55,895	12,900	19,010	2,220	3,300	70	80
Sullivan	33,163	6,502	26,661	1,930	5,690	240	710	90	180
Tioga	24,212	9,417	14,795	2,170	5,500	280	710	30	60
Tompkins	35,285	20,250	15,035	4,750	10,000	600	800	160	200
Ulster	74,979	37,710	37,269	6,020	15,150	890	2,240	160	320
Warren	31,673	18,638	13,035	2,940	6,940	460	1,090	50	180
Washington	44,888	21,381	23,507	3,340	8,660	490	1,270	40	80
Wayne	48,827	18,740	30,087	3,940	10,170	540	1,390	200	400
Westchester	344,436	307,019	37,417	32,320	71,450	6,560	14,500	400	1,130
Wyoming	30,314	14,131	16,183	3,080	6,070	330	650	50	100
Yates	16,641	5,660	10,981	1,340	3,580	160	430	30	60
NEW JERSEY	3,155,900	2,658,047	497,853	317,170	648,540	68,120	151,430	16,490	44,370
Atlantic	83,914	70,313	13,601	8,390	18,970	1,760	3,980	310	970
Bergen	210,703	166,533	44,170	32,190	42,190	4,320	9,940	1,110	1,670
Burlington	81,770	33,766	48,004	4,680	13,130	860	2,410	110	550
Camden	190,508	157,158	33,350	17,530	40,650	3,880	9,000	440	2,360
Cape May	19,460	14,128	5,332	2,180	4,980	420	960	50	250
Cumberland	61,348	40,869	20,479	5,210	12,780	1,030	2,490	240	1,250
Essex	652,089	644,066	8,023	66,000	125,000	15,630	34,700	4,490	6,000
Gloucester	48,224	24,923	23,301	3,600	9,290	670	2,400	70	350
Hudson	629,154	585,159	43,995	62,000	137,600	14,150	31,400	4,430	12,700
Hunterdon	32,885	10,149	22,736	2,220	6,240	360	1,000	90	450
Mercer	159,881	132,694	27,187	13,800	31,990	3,250	7,540	750	1,990
Middlesex	162,334	141,683	20,651	20,000	32,380	5,000	7,860	370	2,070
Monmouth	104,925	70,412	34,513	15,000	23,510	2,500	4,610	400	1,300
Morris	82,694	64,810	17,884	7,680	17,530	1,780	4,060	140	680
Ocean	22,155	9,524	12,631	1,780	4,640	310	810	50	250
Passaic	259,174	227,442	31,732	24,610	55,590	5,540	12,520	2,680	7,720
Salem	36,572	17,719	18,853	2,690	7,110	470	1,240	60	300
Somerset	47,991	26,349	21,642	3,380	8,610	700	1,790	60	300
Sussex	24,905	10,549	14,356	1,720	4,630	300	810	50	250
Union	200,157	182,668	17,489	18,750	42,380	4,480	10,150	470	2,290
Warren	45,047	27,133	17,924	3,760	9,340	710	1,760	120	670
PENNSYLVANIA	8,720,015	6,034,813	2,685,202	581,340	1,642,910	159,940	365,590	28,050	68,050
Adams	34,583	7,791	26,792	1,430	5,400	130	490	90	180
Allegheny	1,185,808	1,017,046	168,762	105,000	238,140	14,500	33,800	1,400	5,350
Armstrong	75,568	22,672	52,896	4,500	10,800	500	1,150	100	200
Beaver	111,621	81,494	30,127	12,000	21,970	1,500	2,750	160	340
Bedford	38,277	5,196	33,081	1,050	5,020	80	380	100	200
Berks	200,854	133,570	67,284	14,780	40,060	1,780	4,820	960	2,360
Blair	128,334	89,266	39,068	8,960	24,410	1,080	2,940	80	270
Bradford	53,166	21,555	31,611	3,050	9,820	600	1,000	90	180
Bucks	82,476	32,010	50,466	4,710	14,690	530	1,650	260	790
Butler	77,270	28,148	49,122	4,500	12,310	1,200	1,500	200	350
Cambria	197,839	129,289	68,550	12,800	26,000	1,850	2,050	330	400

Present and Potential Central-Station Customers in the Middle Atlantic States by Counties—(Continued)

State and County	Population (Census of 1920)			Domestic Lighting Customers		Commercial Lighting Customers		Industrial Power Customers	
	Total	Urban*	Rural	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)
PENNSYLVANIA—(Continued)									
Cameron	6,297	3,036	3,261	510	3,500	120	210	20	40
Carbon	62,565	42,050	20,515	4,140	11,100	600	1,610	70	140
Centre	44,304	10,301	34,003	1,870	6,660	200	710	110	220
Chester	115,120	61,940	53,180	7,230	21,090	920	2,680	160	370
Clarion	36,170	4,455	31,715	660	4,670	400	2,000	40	80
Clearfield	103,236	38,686	64,550	11,350	15,460	640	2,000	350	450
Clinton	33,555	17,895	15,660	2,090	6,080	260	760	80	160
Columbia	48,349	29,873	18,476	3,410	9,480	420	1,170	120	240
Crawford	60,667	25,678	34,989	3,920	12,270	390	1,220	180	330
Cumberland	58,578	29,519	29,059	3,920	11,620	430	1,280	150	300
Dauphin	153,116	115,163	37,953	15,000	32,560	3,000	3,820	900	1,400
Delaware	173,084	117,863	55,221	11,320	30,990	1,470	4,030	280	490
Elk	34,981	19,453	15,528	1,980	5,710	280	810	60	120
Erie	153,536	112,179	41,357	12,160	71,870	220	1,300	500	870
Fayette	188,104	63,510	124,594	7,840	26,480	2,970	10,400	570	1,320
Forest	7,477	0	7,477	110	800	20	150	10	20
Franklin	62,275	26,825	35,450	6,000	10,870	1,500	2,100	490	1,310
Fulton	9,617	0	9,617	150	1,100	30	220	30	60
Greene	30,804	3,332	27,472	730	4,070	270	1,350	40	80
Huntingdon	39,848	11,795	28,053	1,710	6,050	190	670	120	240
Indiana	80,910	24,179	56,731	3,920	11,490	430	850	220	450
Jefferson	62,104	24,797	37,307	2,760	9,320	330	1,110	90	250
Juniata	14,464	1,083	13,381	470	2,050	40	170	50	100
Lackawanna	286,311	275,248	11,063	24,040	58,000	3,320	8,000	570	1,160
Lancaster	173,797	84,239	89,558	11,460	33,090	1,240	3,580	1,230	1,920
Lawrence	85,545	55,313	30,232	5,860	16,210	760	2,100	90	290
Lebanon	63,152	34,841	28,311	4,470	12,540	540	1,520	120	670
Lehigh	148,101	93,619	54,482	10,210	28,130	1,190	3,280	40	900
Luzerne	390,991	289,973	101,018	30,000	67,320	5,000	9,370	590	1,300
Lycoming	83,100	54,020	29,080	6,050	16,900	720	2,010	290	690
McKean	48,934	24,302	24,632	2,880	8,880	330	1,020	170	350
Mercer	93,788	60,131	33,657	6,420	17,820	820	2,280	100	290
Mifflin	31,439	14,159	17,280	1,930	5,570	210	610	50	100
Monroe	24,295	10,133	14,162	1,260	4,160	140	460	60	120
Montgomery	199,310	96,413	102,897	11,340	33,690	1,330	3,960	520	1,170
Montour	14,080	6,952	7,128	720	2,240	90	280	30	60
Northampton	153,506	121,746	31,760	12,130	31,450	3,000	5,000	350	900
Northumberland	122,079	80,092	41,987	7,830	21,820	960	2,790	180	480
Perry	22,875	5,528	17,347	1,080	3,850	110	390	70	140
Philadelphia	1,823,779	1,823,779	0	100,500	360,000	88,000	184,000	11,400	31,000
Pike	6,818	1,535	5,283	610	1,500	60	110	30	60
Potter	21,089	2,836	18,253	620	2,970	40	190	50	100
Schuylkill	217,754	149,254	68,500	14,140	38,020	1,920	5,150	150	970
Snyder	17,129	1,937	15,192	690	2,730	60	240	50	100
Somerset	82,112	24,215	57,897	3,710	13,460	360	1,300	110	220
Sullivan	9,520	1,250	8,270	440	1,430	50	160	30	60
Susquehanna	34,763	13,810	20,953	1,990	4,000	500	670	80	100
Tioga	37,118	7,094	30,024	1,420	5,950	110	460	60	120
Union	15,850	4,948	10,902	790	2,850	70	250	30	60
Venango	59,184	31,244	27,940	3,640	10,840	430	1,280	100	210
Warren	40,024	15,822	24,202	4,100	7,000	350	710	300	500
Washington	188,992	93,978	95,014	9,580	30,340	3,940	12,480	630	1,280
Wayne	27,435	6,237	21,198	1,160	4,430	110	420	110	220
Westmoreland	273,568	132,107	141,461	14,820	42,690	5,240	15,100	700	1,460
Wyoming	14,101	1,736	12,365	730	2,570	70	250	30	60
York	144,521	64,673	79,848	8,690	26,550	990	3,020	1,320	2,140

*Cities and towns over 1,000 population.

reports which have been received by the ELECTRICAL WORLD from operating companies representing about 70 per cent of the installed generator rating of the country, supplemented by population and industrial power data issued by the United States Census Bureau. The data obtained in this way were in each case referred to a representative company operating in the county concerned with a request that an opinion be given as to whether the data represented with a fair degree of accuracy conditions existent in that county. In the few cases where the company to which the figures were sent indicated that the ELECTRICAL WORLD figures were at variance with conditions in the county a new study was made and the data were corrected accordingly. The figures for the various counties, although estimates, are believed to indicate very clearly the present and future potentialities of the counties as ultimate purchasers of electrical apparatus, appliances and supplies.

A similar tabulation showing the distribution of the central-station customers in New England was published in the April 28, 1923, issue of the ELECTRICAL WORLD, and studies are under way covering other sections of the country.

Radio Telephony in South America

IN SANTIAGO, Valparaiso, and several smaller Chilean cities interest in radio telephony is growing steadily, and its fuller development only awaits the establishment of a broadcasting station within the country such as those now in operation on the east coast of South America, says Assistant Trade Commissioner W. E. Embry in a report to the Department of Commerce.

It is reported that broadcasting stations recently erected in Buenos Aires, Montevideo and Rio de Janerio are giving very satisfactory results, and large numbers of amateur receiving sets have been sold in these countries. This is especially true of the Argentine, where conditions for broadcasting programs are almost ideal as the land generally is flat and radio transmission carries all over the River Plate district, Uruguay and in southern Brazil on the north and as far as the Andes on the east. For this reason the sale of radio equipment has met with great success in that country, and it is now estimated that there are approximately twenty-five thousand sets in the Argentine Republic, in comparison with about one hundred less than one year ago.

Davis Bridge Development of the New England Power Company

Another Step in "Electrification" of Deerfield River—Ultimate Yield of Watershed 200 Kw. per Square Mile—High-Voltage Trunk Line to Load Center of System—Flexible Double Switching Yards

By A. C. EATON* and E. B. COLLINS†
New England Power Company, Worcester, Mass.

THERE is under way at present in New England a project involving the eventual complete utilization of the hydro-electric possibilities of the Deerfield River. Back of it stands the New England Power Company. Nine generating stations will be placed along the river ultimately, which will have an installed capacity of 110,000 kva. and an annual output of nearly 400,000,000 kw.-hr. Yet the river is small, having a drainage area of only 550 square miles.

Of the planned number, four stations are completed and the Davis Bridge development is nearing completion. The last named project is at Whitingham, Vt., and will consist of a storage reservoir having a usable capacity of 111,000,000 acre-feet and a plant with an installed capacity of 60,000 hp., operating under a mean head of 350 ft. The reservoir, together with the completed Somerset reservoir, with its 58,000 acre-feet, will regulate the river flow for the Davis Bridge plant, the four completed plants and the four projected plants.

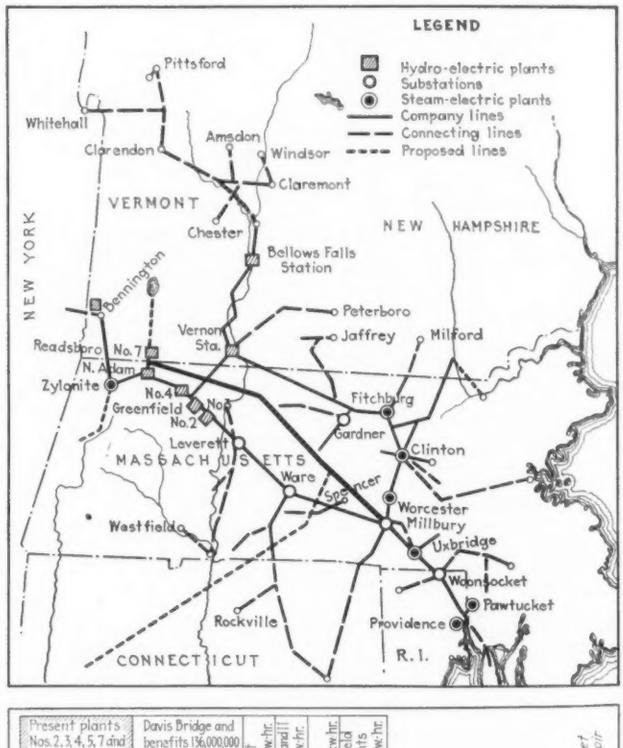
The Davis Bridge development extends fourteen miles along the river and its dam is built about 3 miles above Readsboro. The dam will impound water for 9 miles, causing about 2,200 acres of land to be flooded. A tangent, concrete-lined tunnel 2½ miles long and the equivalent of 14 ft. in diameter extends through rock to the power house below Readsboro. The earth dam, when completed, will be 200 ft. high, 1,200 ft. long and about 1,200 ft. wide at the base. With its 2,000,000 cu.yd. of earth it will be a mammoth structure and will be one of the highest dams of this type, if not the highest, in the world.

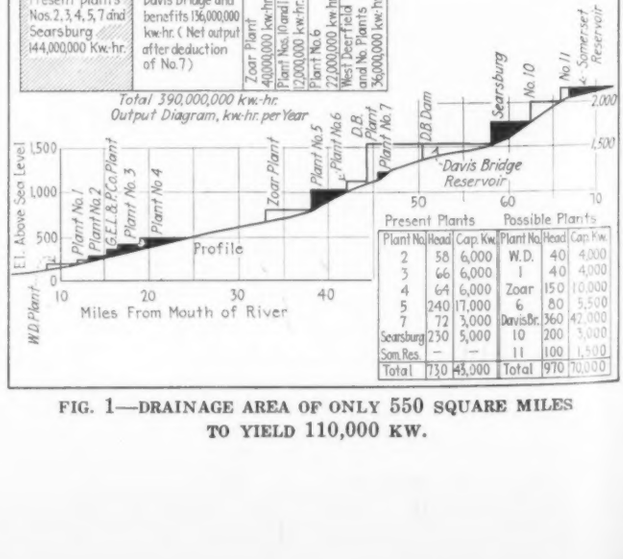
A tunnel with a diameter equivalent to 22½ ft., with a capacity of 20,000 sec.-ft. and 1,200 ft. long, was constructed under the left bank of the river to carry the water while the dam was under construction. Because of the narrow valley, a circular spillway is being constructed about 350 ft. upstream from the center line of the dam. This spillway is 160 ft. in diameter and discharges into a vertical shaft 22½ ft. in diameter and 180 ft. deep. The shaft in turn discharges into the lower end of the temporary bypass tunnel, which will be plugged at its upper end upon completion of the dam. A model of the spillway was made and tested to verify design calculations and to determine certain details of the design.

USE OUTLET CONTROL TOWER

The flow of water to the power tunnel will be controlled by a concrete tower, 125 ft. high, built about 300 ft. above the dam. This tower will permit the reservoir to be lowered 90 ft. during a normal season's operation and will have a clear section at all times through the use of racks placed on one side and extending to the top. In the base of the tower two Morgan Smith disk-arm-type valves can be used to shut off the water.

At the lower end of the power tunnel a 10-ft. side connection leads to a Johnson differential surge tank made by the Riter-Conley Company. This tank is made of steel plate and is 34 ft. in diameter and 184 ft. high. Just below the side connection to the surge tank is a





Plant No.	Head	Cap. Kw.	Plant No.	Head	Cap. Kw.
2	58	6,000	W.D.	40	4,000
3	66	6,000	1	40	4,000
4	64	6,000	Zoar	150	10,000
5	240	17,000	6	80	5,500
7	72	3,000	Davis Br.	360	42,000
Searsburg	230	5,000	10	200	3,000
Som. Res.	—	—	11	100	1,500
Total	730	43,000	Total	970	70,000

FIG. 1—DRAINAGE AREA OF ONLY 550 SQUARE MILES TO YIELD 110,000 KW.

*Hydraulic engineer. †Assistant electrical engineer.

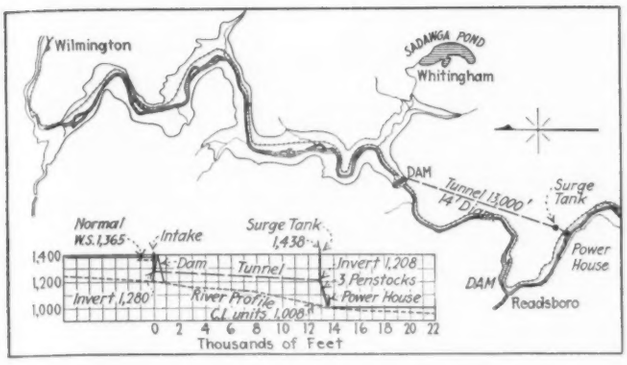


FIG. 2—POWER TUNNEL HALF AS LONG AS RIVER BETWEEN DAM AND PLANT

manifold with three branches leading through Coffin 8-ft. disk-arm valves to the 9-ft. penstocks furnished by the Lancaster Iron Works. The penstocks conduct the water to the power house, which is about 60 ft. by 110 ft. in plan and has a concrete substructure and a brick-steel superstructure. The turbines will operate with a maximum head of 390 ft., a minimum head of 300 ft. and a mean head of 350 ft.

STATION ELECTRICAL ARRANGEMENTS

The initial electrical installation will consist of two General Electric 16,000-kva., 6,600-volt, three-phase, 60-cycle, 360 r.p.m. vertical waterwheel-driven generators, completed, with 90-kw., 250-volt directly connected exciters. The waterwheels are rated at 20,000 hp. and, together with the inlet valves, were furnished by Allis-Chalmers. Provision is made for the installation of a third unit in the future.

On the main floor of the station are the 16,000-kva. generators, each supported by a concrete pedestal which raises the generator about 5 ft. above the floor. Each generator is inclosed in a sheet-iron envelope which forms a housing, so that the hot air from the machines is discharged outside of the building. There are several doors in the envelopes, which make it possible to use this air for heating the building if desired.

UNIT PLANT DESIGN

Energy is taken from the generators by means of three 700,000-circ.mil single-conductor cables per leg to the main bus structure, where by suitable oil switches it is fed to the bus or to the power transformers. The station is laid out on the unit basis; one exciter, generator and transformer making up a unit. It is intended that only one machine at a time shall be connected to the main bus, and this bus is primarily used for carrying the station auxiliary transformers and local feeders. It is, however, of sufficient size to allow any generator to be used with any transformer. The auxiliary bus is connected to the main bus through a 1,500-kva., 3 per cent reactor (Fig. 3), thus allowing the use of small switches for station and local feeders. The main bus is separated by barriers, and the whole, together with the three-phase reactor, is inclosed between concrete barrier walls with all blade switches so arranged that they may be operated without entering the bus chamber. Complete duplicate station service transformers and switching equipment are provided, separated by a barrier wall. The auxiliary 6,600-volt bus and local 2,300-volt bus are run in fiber duct embedded in the barrier wall and exposed only at points where connections are made to them. They consist of No. 4/0 solid 13,200-volt varnished-cambric conductor.

The outgoing conductors from the transformer oil switches to the transformers consist of three three-phase, 700,000-circ.mil, 7,500-volt, varnished-cambric, lead-covered cables per transformer, one leg of each phase being carried in each cable in order to eliminate sheath current.

The oil switches are all cell-mounted, the back wall of the cells being carried up to the under side of the switchboard gallery, and the switches located on the side of this wall away from the station, thus eliminating any possibility of switch trouble endangering the generators. The operating solenoids and control relays for the switches are mounted on the mezzanine floor and on the side of the above wall, adjacent to the generators, where they are readily accessible for inspection and free of danger from switch trouble.

AUXILIARY PANELS CARRY TERMINAL BLOCKS

The switchboard is of the vertical type, and for each panel there is provided an auxiliary panel mounted in back of the main panel and 6 ft. from it. All control and meter wires are first brought to the auxiliary panels, where, after passing through terminal blocks, they go to the indicating meters on the main panels and then to the watt-hour meters and relays, which are installed on the auxiliary panels.

On the main floor by each generator is a panel on which are mounted the solenoid-operated field switches and signal boxes. By means of these the governor man receives orders from the operator for starting and stopping the machines. There are also mounted on these panel push-button stations for signaling the operator and for emergency stopping. The generator fields are provided with amortisseur windings, and the generator panels are so wired that phasing may be done in the regular way, or the operator may, by closing a control switch, cause the generators automatically to phase in. This is accomplished by means of speed switches on the generator, which close when the generator has attained 95 per cent of synchronous speed.

The 6,600-volt energy from the generators will be

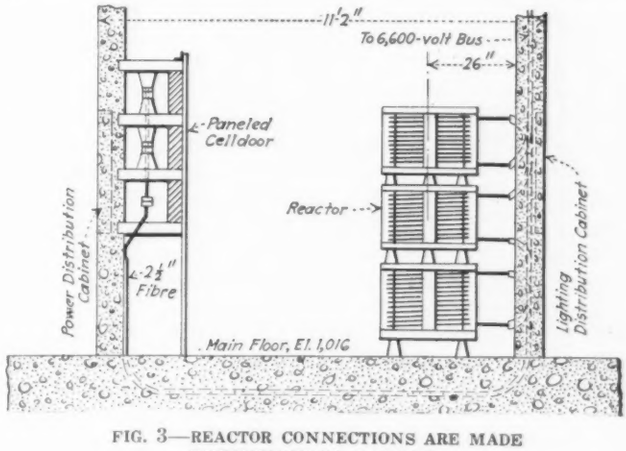


FIG. 3—REACTOR CONNECTIONS ARE MADE THROUGH WALL CONDUITS

stepped up to 110,000 volts by means of two General Electric 16,000-kva. outdoor water-cooled, conservator-type transformers connected delta on the low side and Y on the high. The energy is delivered to outdoor duplicate high-tension buses. Energy from other nearby stations at 66,000 volts will be brought to the Davis

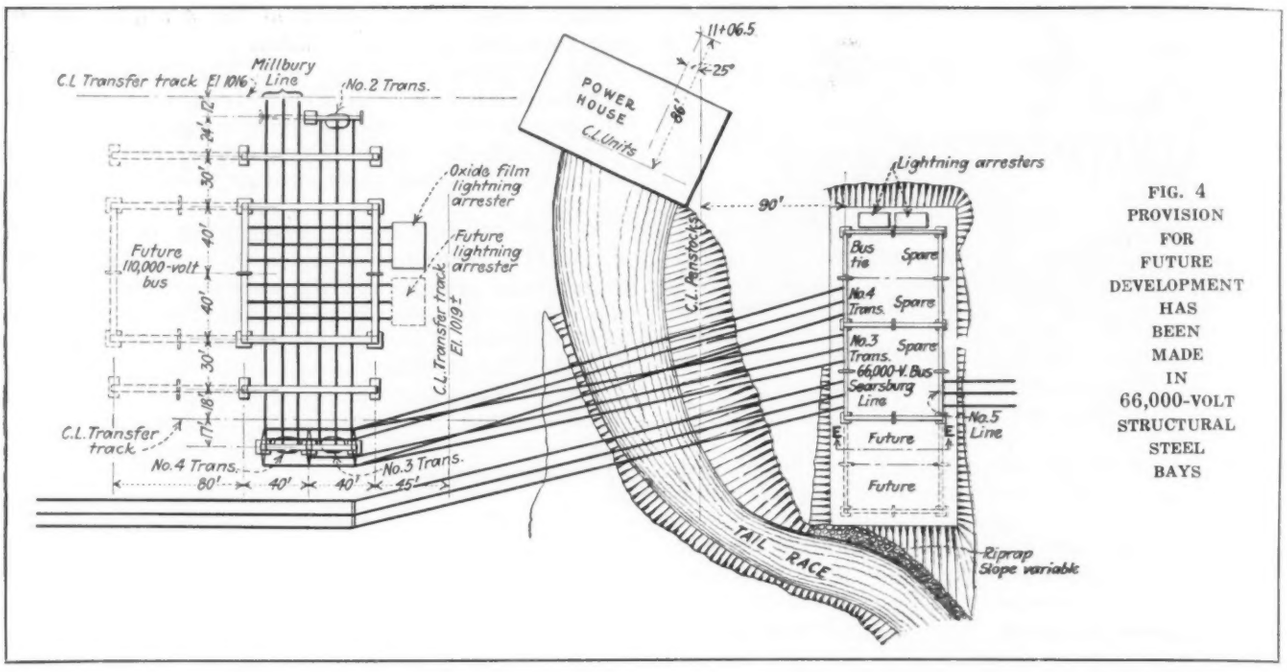


FIG. 4 PROVISION FOR FUTURE DEVELOPMENT HAS BEEN MADE IN 66,000-VOLT STRUCTURAL STEEL BAYS

Bridge station and stepped up to 110,000 volts by means of a 15,000-kva. water-cooled auto-transformer. As a reserve, in case of failure of the auto-transformer, one of the 16,000-kva. units is provided with a full capacity auto-transformer connection on the high-tension winding. On the 66,000-volt and 110,000-volt windings of all transformers taps are provided for voltages 5 per cent and 10 per cent above and 5 per cent below the rated value. Ratio adjusters are installed so that the taps may be changed without entering the transformer tanks.

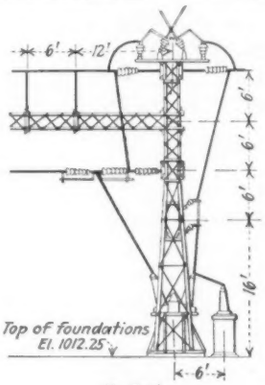
The transformers are mounted on wheels and may be rolled into the station, where pit and crane facilities are provided. In addition a 7,500-gal. oil-storage tank, with filter and piping system, is provided, together with a compressor for forcing the oil through the system to the filter press pump.

Two-Voltage Switching Facilities

There will be two complete outdoor double-bus, galvanized-steel switching stations (Fig. 4), one for 66,000 volts (Fig. 5) and one for 110,000 volts (Fig. 6), separated by the tailrace, as may be seen by the accompanying plan view. Both stations will be equipped with oxide-film lightning arresters, one being connected to each of the buses rather than one for each line, and suspension-type choke coils will be installed in all high-tension leads to the transformers. The main buses in the 110,000-volt yard are medium-hard-drawn 400,000-circ.mil copper, and the taps are No. 4/0, while the main 66,000-volt buses are No. 4/0 medium-hard-drawn and all taps No. 2/0. The present 110,000-volt structure consists of two bays arranged for two circuits per bay, with provision for four additional bays. The 66,000-volt bus structure consists of four bays arranged for two circuits per bay, with provision for two additional bays.

All transformer and line oil switches are provided with bus selector switches and also shunt air-break switches, so that any oil switch may be taken out of service at any time for inspection and adjustment without disturbing the circuit. The 66,000-volt yard is connected to the 110,000-volt yard by two No. 2 tie circuits through the auto-transformer or the auto-connection on one of the main transformers. At present the bay for the transformer for the third generator will be used for the line switch for the outgoing 110,000-volt line.

This line is a double-circuit No. 4/0 110,000-volt steel-tower trunk line with the conductors in a horizontal plane to extend for a distance of 77 miles from Davis Bridge station to the Millbury substation and load-dispatching center, which is 7 miles south of Worcester. The line follows a 250 ft. private right-of-way the entire distance, and the towers are built on one side of the right-of-way so that a second line may run later should the need arise. A single circuit is being put in at present, but the second will probably be run when the third unit is installed. In order to facilitate the outdoor switching, telephone booths will be installed in both the 66,000-volt yard and the 110,000-volt yard.



A private telephone line on wooden poles follows the right-of-way, giving direct communication between the station and the dispatcher at Millbury. This means of communication will be supplemented by a carrier-current

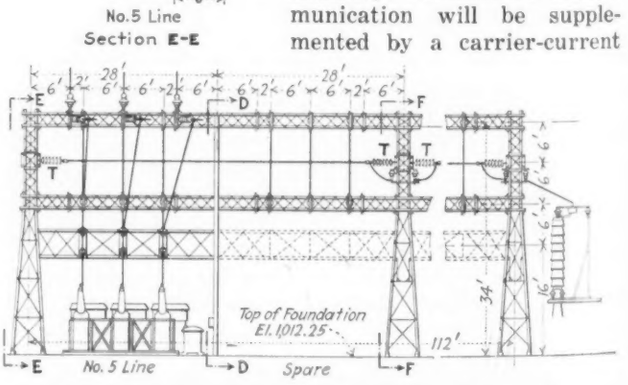


FIG. 5—SYMMETRICAL DESIGN FACILITATES OPERATION OF 66,000-VOLT EQUIPMENT

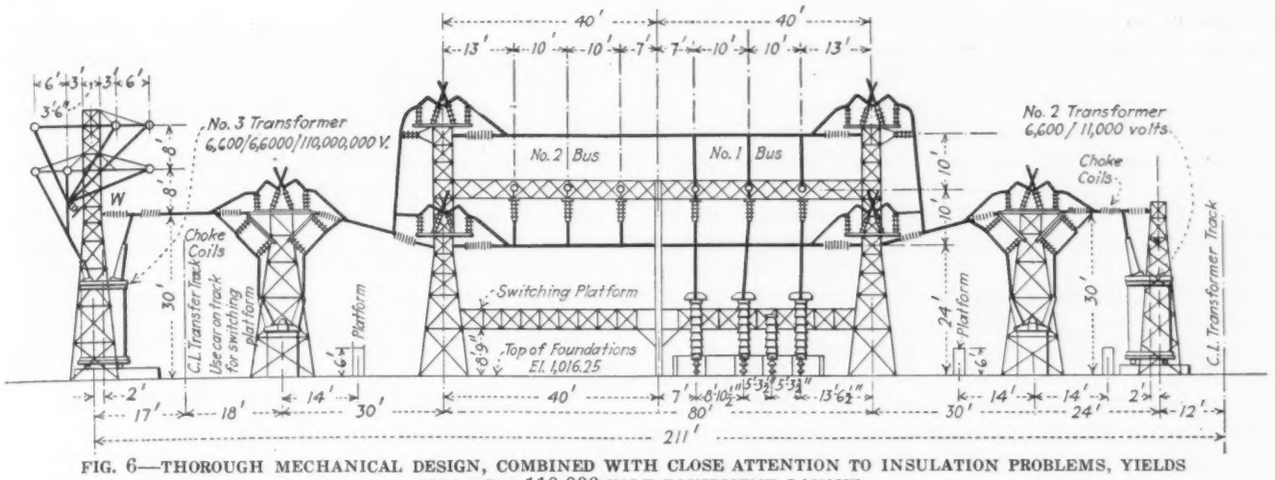


FIG. 6—THOROUGH MECHANICAL DESIGN, COMBINED WITH CLOSE ATTENTION TO INSULATION PROBLEMS, YIELDS ATTRACTIVE 110,000-VOLT EQUIPMENT LAYOUT

telephone outfit similar to that which is already in use elsewhere on the system.

The New England Power Company, through its engineering and construction department, the Power Construction Company, is handling this work. The bypass tunnel contract was let to the Rollin Construction Corporation, the dam to the W. F. Carey Company, the power tunnel to the Mason & Hanger Company, and the power-house substructure to the L. H. Shattuck Company. With its own forces the Power Construction Company is clearing the reservoir basin, relocating highways, building 8 miles of relocated railroad, building the 77 miles of new 110,000-volt transmission line and handling many other items of lesser magnitude.

Attendance at Technical Schools in1923 More than 70,000

THE following table, compiled by Walton C. John of the United States Bureau of Education, presents an interesting epitome of the attendance at technical colleges and schools this year, with the total figures for 1922 included for comparison:

ATTENDANCE IN ENGINEERING AND MINING SCHOOLS IN THE UNITED STATES

Courses	Freshmen and Sophomores	Juniors	Seniors	Total	Specials	Candidates for Advanced Degrees
Civil engineering	*11,204	2,433	2,018	12,167	492	313
Mechanical engineering	*6,027	2,637	2,481	13,682	160	95
Electrical engineering	*7,661	2,658	2,360	13,630	77	123
Chemical engineering	2,427	1,082	1,097	4,606	23	111
Mining engineering	752	438	536	1,726	85	49
Architectural engineering	768	172	165	1,115	20	2
Textile engineering	227	97	93	417	41	1
Industrial engineering	225	165	69	459	1	1
Aeronautical engineering	21	21	23	65	1	18
Sanitary engineering	16	9	10	35	1	14
Geological engineering	13	25	59	97	2	10
Ceramic engineering	84	37	20	141	2	...
Agricultural engineering	81	31	21	133	3	7
Engineering, general and unclassified	386	142	105	633	6	...
Miscellaneous	348	242	157	747	2	6
Chemistry	317	170	223	710	9	108
Physics	19	7	39	65	...	13
Architecture	469	149	154	772	32	6
Metallurgy	65	76	66	207	3	6
General science	6	6	9	21	...	2
Six courses at Massachusetts Institute of Technology	291	140	224	655	37	35
Total in 1923	31,407	10,747	9,929	52,083	997	920
Total in 1922	32,178	11,446	8,520	52,144	....	....

*The figures show the enrollment, based upon the undifferentiated courses of the freshman-sophomore years.

Some Effects of Current in Metallurgical Operations

Superior Physical Properties of Alloys Produced in Electric Furnaces May Be Due to Electrical Field Effect on Molecular Structures

BY B. D. SAKLATWALLA
General Superintendent Vanadium Corporation of America

IN THE course of a discussion of electric furnaces at the last spring meeting of the American Institute of Electrical Engineers the author made the suggestion that other effects of the electric current besides the thermal one should be taken into consideration in electric furnace work. The effect of the current on the molecular structure of the molten metal was hinted at. As this idea seems to have found accord it appears opportune to discuss such effects a little more fully.

It has been a generally accepted metallurgical fact that alloys, ferrous or non-ferrous, produced in the electric furnace possess physical properties superior to those of the same alloys produced in combustion furnaces. This superiority has been ascribed to the apparently higher temperature and absence of combustion gases in the electric furnace. The possibility of refinement through the electrical or magnetic effect produced by the current on the material in the molten state has been totally overlooked. Such effect, however, is undoubtedly present. The passage of heavy currents through a molten mass between the arcs is surely accompanied by electrical and magnetic phenomena in that mass producing mechanical effects. Besides, at the points where the arcs are at play there will be some violent stirring and probably a disintegration of the bath material accelerating ebullition and volatilization. In the induction furnace this disintegrating effect might be absent, but the stirring or swirl effect might be more pronounced. These apparent effects have been noticeable to every furnace operator.

There are, however, other effects which may not be externally apparent and may partake more or less of a molecular nature. The metallurgical art aims at elimination of undesirable constituents from a bath of molten metal by chemically slagging off such constituents and thus separating them from the metal. This separation, after completion of the chemical reactions, in the combustion furnaces is dependent only on the difference

in specific gravity of the constituents. In the electric furnace it is possible that the different molecules of the molten bath, finding themselves in an electric or magnetic field, follow a separation dependent on the difference of their electric characteristics, such as conductivity, permeability, etc. Further, the electric alternating tension present may cause a molecular vibration, thus aiding gravitational separation of the metallic and non-metallic constituents, either solid or gaseous. This idea of alternating vibrations leads to the question of frequency and its effect in setting up such molecular motion. As commercial experience in electric furnaces has been in the ranges of low frequencies of 25 cycles or 60 cycles, knowledge as to its effect is virtually absent. The high-frequency induction furnace of the Northrup type, developed on a comparatively small scale, has nevertheless shown excellent results as to quality of product. During the process of melting down or refining in such a furnace the high frequency may contribute to the quick disintegration of the cohesion bonds between the molecules, thus accelerating their liquefaction, or the molecular vibrations set up may facilitate separation of impurities, enhancing the quality of the product. With the advent of the electron vacuum tubes and the comparatively easy method of producing high-frequency currents by their aid, study of this effect and the commercial application of its results appear near at hand.

The molecular electrical effects which help to refine molten metals in the furnace can also be usefully applied to refine the structure of metals during the period of their solidification in a mold. The physical properties of the metal are dependent to a very large extent on the structure of the solidified ingot, on the size of the crystal aggregates and their arrangement and relation to each other. Solidification under ordinary circumstances takes place, depending on the size and shape of the mold, at a more or less uncontrolled rate and in a manner not influenced in any way by the will of the operator. A study of cooling of a metal ingot under electrical conditions produced around or in the ingot might lead to means of controlling the crystallization of the ingot and the physical properties of the finished metal. Crystal growth or solidification in an ingot is the tendency of the atoms to form stronger cohesion bonds among themselves and to ordinate along definite geometrical directions. The assumption that such cohesion bonds are of an electromagnetic nature seems to be gaining ground. If this is true and the solidification process takes place in an electrical or magnetic field, it will undoubtedly be influenced by this field, depending on its intensity. As it would be an easy matter to regulate the electrical or magnetic characteristics of the field at will, it can readily be seen that by this means the process of solidification or crystallization of a metal ingot can be controlled. Not only this change in crystal growth rate can be brought about, but also mechanical effects, such as a molecular stirring or vibration, can be set up which may eliminate excessive primary crystal growth, or gas blowholes, or non-metallic inclusions. For the elimination of these defects, at present, chemical means are employed, such as additions of alloying elements, which tend to refine structure, or scavenging agents, which tend to remove gases and solid non-metallics.

The methods of creating electrical or magnetic conditions in the solidifying ingot can be several and varied. An induced field can be produced by means of extraneous coils, or a direct electrolyzing current can be sent through the body of the metal, or an alternating current can be used in the same manner, this current being of low or high frequency. Undoubtedly each of these means will produce a different result.

Investigations along these lines will probably reveal results of a very striking character and may very radically alter some aspects of alloy metallurgy. Moreover, such investigations afford another substantiation of the utility of electrical energy in achieving remarkably useful results by comparatively simple means.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

"Did It Happen on the Wire?"

To the Editors of the ELECTRICAL WORLD:

The writer enjoyed reading in your issue of May 26 the letter by Walter C. Hecker relative to careless business methods of the central-station interests. A person familiar with the lax methods and the lack of system prevailing in the average business organizations, except the extra-large corporations and the national banks, would not be at all surprised at Mr. Hecker's complaint even though his method of making it might cause an inward chuckle at the expense of the central station.

The exigencies of the time have replaced days and weeks by minutes, and the ever-handy telephone is turning many a black hair gray. Not so long ago we would not think of attempting installations of even minor importance until all details were shown over somebody's signature, but the mad scramble for orders now in vogue has brought in the telephone and the unstable human brain to supersede the written record.

I venture to say that the gist of the motor transaction mentioned by Mr. Hecker consisted of a few telephone inquiries by his customer or his salesman from some overworked employee of the contracting department of the central station. This employee, probably attending to several customers at the same time, simply collected his thoughts as best he could and answered "Three-phase," when, as a matter of fact, the entire situation should have been checked by one of the commercial engineers before any attempt was made to answer the question. I know from experience that such transactions occur hourly, and if the people demanding this immediate telephone service only knew what a proper answer really meant to them, they would prefer to get their rulings in writing. They should wait their turn in line and not expect to be treated on a preferential basis by telephone.

The telephone is one of our greatest conveniences, but when used to transact business that requires time and investigation to reach a proper decision it becomes an instrument of imposture. The writer has made it a rule never to give official rulings over the telephone, and when the case demands careful study never to give important information orally.

The telephone query is assumed to be a part of the procedure that Mr. Hecker leaves between the lines.

GEORGE WELMAN,
Chief Electrical Inspector.
Louisiana Fire Protection Bureau, New Orleans, La.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Interstation Communication Developments

Wire, Space and Carrier-Current Systems Analyzed—Combination of Space and Carrier-Current Methods Ideal System—Advantages and Disadvantages of Each

EXTENSIVE progress in the development and perfection of radio-communication methods and equipment applicable to power company needs is anticipated in the report of the sub-committee on communications of the Pacific Coast Electrical Association to be presented June 19 to 22. Many power companies are, besides, carrying on their own research investigations and meeting with considerable success. Some of the general conclusions of the report are given below.

Wired communication for ordinary routine and load-dispatching communication requirements is, the committee says, usually to be preferred to radio, mainly on account of its present high degree of perfected simplicity. However, it should be supplemented by some means of reliable auxiliary communication, such as "space" radio or "carrier-current" radio, in order to be of the maximum value to power companies in cases where almost uninterrupted communication is a requisite.

Space radio functions very satisfactorily in such instances under many conditions, the report goes on, and where the distances to be spanned do not greatly exceed 100 miles of average topographical features and the stations are not near a large commercial or government station, reliable communication service can be effected at practically all times, without prohibitive installation costs. Before making space radio communication installations in a mountainous country, careful preliminary tests should be made to determine the approximate size of transmitter that is actually required to guarantee reliable communication under the existing topographic conditions. Careful consideration also should be given to the choice of proper wave lengths to reduce outside interference to a minimum.

The fact that the stations are required to be licensed and operated only by licensed operators is a slight objection in some respects, it is admitted, but this feature usually insures a competent man who can be trained for other duties in addition to those of being a radio operator.

Carrier-current radio makes use of transmission-line conductors as "carriers" for the radio-frequency communication energy, besides effecting a marked saving in transmitter energy consumption during normal operating conditions. This system is not affected by the topographical nature of the intervening country, thus making the carrier-current system particularly desirable for application to transmission lines through mountainous sections, where the efficiency of "space" transmission is usually very severely attenuated.

The "carrier" type installation, however, cannot, the report points out, effect communication properly when all conductors of the "carrier" line are grounded, when all conductors of the "carrier" line are severed, or when "carrier" line-sectionalizing switches are opened, unless such switches are properly bypassed by some type of bypassing antenna or other device.

In the event of two or more transmission circuits being carried along the same tower line or right-of-way and being used as a part of the carrier system, the chances for all conductors being grounded or severed are somewhat remote. In the case of the single-circuit transmission line this condition is apt to occur.

Summary of Advantages and Disadvantages of Different Types of Communication Systems

Wire Communication

ADVANTAGES

1. Simplicity of operation.
2. Permits simple duplex communication.
3. Operation independent of topography.
4. Privacy of communication.
5. No station license required.
6. Calling system available.

DISADVANTAGES

1. Service interruptions from line failures, particularly during severe storms.
2. Service interruptions due to trouble on power line, which the communication line closely parallels, causing intense inductive interference.
3. Repairs of line failures often effected very slowly and with difficulty because of remoteness.

"Space" Radio Communication

ADVANTAGES

1. Entirely independent of all interconnecting lines and their possible failures.
2. Equipment all located at points of operation and thus always readily accessible for repairs when necessary.
3. Usually affords means of communication with commercial or government radio stations in an emergency.

DISADVANTAGES

1. Transmission efficiency subject to intervening topographical conditions.
2. Somewhat subject to outside interference from other stations in some locations.
3. Subject to severe atmospheric interference in some localities for certain periods of season.
4. Duplex communication expensive and somewhat complicated.
5. Lack of privacy of communication.
6. Station must be licensed and operated by licensed operator.

"Carrier-Current" Radio

ADVANTAGES

1. Independent of intervening topographal features.
2. Much less power required to cover a given distance than with "space" radio.
3. Greater freedom from external disturbances, such as static, and interference from other radio stations.
4. Privacy of communication.
5. Station license and licensed operator not required.
6. Call-bell system available, not necessitating operator to be listening in to receive calls.
7. Expensive antenna supports and elaborate ground system not required.
8. Little interference created in outside communication systems.
9. Operator may listen to power-line conditions.

DISADVANTAGES

1. Communication subject to interruption when "carrier" line conductors all become severed or grounded owing to line failure.
2. Necessary to "bypass" line switches, auto-transformers, etc.
3. Necessitates use of large transmitter when applied to a "carrier" system composed of a large network of lines or to a transmission line with a very large number of tap feeders or substations.
4. Duplex communication rather complicated and expensive at the present time when applied to telephony.
5. Somewhat more subject to interference from transmission line disturbances, such as discharging insulators arcing grounds, etc., than "space" radio.

but the possibilities for continuous operation are much in favor of the carrier system, even in this case, as compared with the wire-communication line, when it is remembered that a short circuit, ground or break of either of the two conductors of the wire line will cause an interruption to communication service.

A number of data have been reported in the past relative to the ability of the carrier-current radio system to effect communication through open line switches, past severe breaks in the line and through solidly grounded lines. It is the conservative opinion of the committee that such cases are misleading, since it is believed that if they are carefully analyzed it will be found in each case that communication was really effected by space transmission, if the distance between the two stations was comparatively short, or else there has been a means of bypassing the carrier radio energy past the fault that was not realized at the time of the incident.

Bypassed Transmission Line

For example, there may be a twin-circuit and single-circuit transmission line connecting two points of operation separated a hundred miles or more. If line-sectionalizing switches opening both circuits of the twin lines are operated and tests made, the impression might be gained that the carrier system was jumping the switch, whereas in reality it is being routed over the single-circuit line. Similar reasoning will apply in the case of solid grounds on all conductors of the twin-circuit line, or even in the extreme case of all conductors of the twin line being severed and grounded. Moreover, a near-by communication or low-tension power line may possibly serve as a bypass if it parallels the carrier line at the point of open switches or severed conductors.

Actual tests have been made by some power companies which prove that the antenna of the carrier system is a fairly efficient space radiator, even when being used as a carrier antenna and placed very near the transmission-line conductors. This fact may have been overlooked during certain carrier tests with open-line switches, grounds, etc., and reported reception through such faults may have been accomplished in reality by space transmission.

Carrier-current radio functions well, the report goes on to say, but its efficiency should not be overestimated, and its advantages and disadvantages should be relatively weighed and compared with those of the other means of communication.

The ideal auxiliary communication system in most cases would, it is concluded, be a combination of the space and carrier current systems. The logical use of such a combined installation would be to utilize the carrier system at all possible times (for reasons apparent from reviewing the advantages under carrier-current radio in the accompanying summary); then, in the event of failure of the carrier system due to severe transmission line trouble, it is possible to throw over to the space radio antenna, increase power output of transmitter, retune the transmitter if necessary and continue operations.

Naturally, the size of the transmitter in this case must be several times what it would be for straight carrier service, particularly in mountainous sections. In some cases intermediate stations could be utilized to relay the communication through if necessary, thereby permitting the size of the transmitters to be smaller than they would otherwise necessarily have to be to guarantee dependable space transmission over comparatively long distances.

The principal disadvantage of this combined system would be that under the present regulations of the Department of Commerce stations of this character utilizing a space antenna would be subject to the rules and regulations applying to a limited commercial radio system. This, the committee says, would necessitate the station being licensed and operated by a licensed operator.

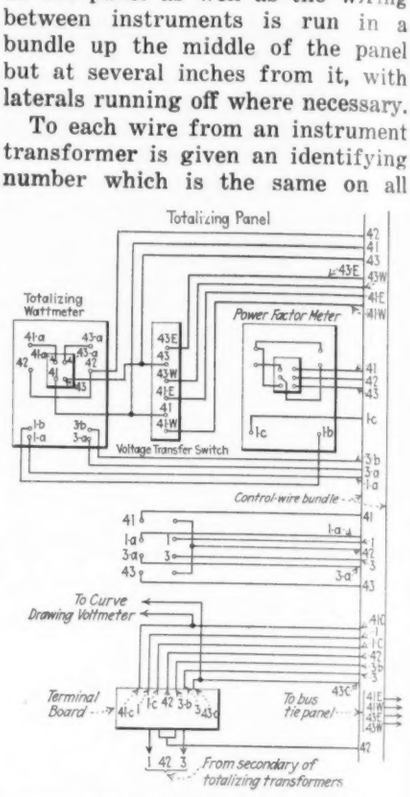
FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

Identifying Control Wires

IN TRACING control wiring to check an actual installation against the wiring diagram it is usually difficult to follow any specific circuit amid a maze of other wiring. This may delay installation work or changes when time is an important factor. Furthermore, some error may be made which may be difficult to discover.

To avoid these objections the Alabama Power Company has adopted a very simple numbering and tagging system for all control wiring. All secondary leads from current and potential transformers are brought into a terminal board mounted at the base of each panel several inches back of it. On this terminal board are short single-pole knife-blade switches without any handles but having lugs which facilitate their being operated and closed when tests must be conducted. From this board the control wiring to instruments on the panel as well as the wiring between instruments is run in a bundle up the middle of the panel but at several inches from it, with laterals running off where necessary.

To each wire from an instrument transformer is given an identifying number which is the same on all



IDENTIFICATION PLAN FOR LEADS

Tag system combined with successive lettering of leads as they pass through instruments an advantageous method.

panels. After it runs through an instrument a letter is appended to the number, starting with *a* and changing to the next letter in the alphabet each time the circuit passes through an instrument.

For example, consider circuit No. 1 at the bottom of the accompanying illustration. It runs to the cable bundle and emerges a slight distance above, goes through the totalizing watt-hour meter and emerges as No. 1a. It again enters the cable bundle and emerges again above, going to the totalizing wattmeter, from which it comes out as No. 1b and goes to the bus power-factor meter. From this it emerges as No. 1c and enters the cable bundle. At the bottom it comes out again and returns to the test block as No. 1c.

At each terminal a round fiber tag (½ in. in diameter) is attached bearing the identifying number stenciled in its surface. The tags are very durable and not easily defaced.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Analyzing Interruption to Hydro-Electric Service*

ANALYZING interruptions to service calls for a standard of measurement that should be quantitative primarily and qualitative only when there is no way to express quality except by comparison with the general service experience familiar from steam practice. Quantitative measurements refer to the duration of a disturbance in minutes and seconds, to the amount of load lost, and to the extent of fluctuations of voltage and frequency at times when no load is visibly lost, but when, nevertheless, service is not perfect.

The standards that are referred to in the classification of disturbances (Table 1) are those developed during the past ten years of combined hydro-steam operation in the Baltimore-Lancaster load centers, where the Pennsylvania Water & Power Company furnishes the hydro-electric power from a development on the Susquehanna River at Holtwood, Pa. Naturally these records will refer only to the few minutes and seconds and fractions thereof when service was not 100 per cent perfect, regardless of whether trouble originated on the hydro-electric system proper, or at the steam plants operated in parallel, or on the general distribution system.

Public utilities intrusted with the supply of power to the large cities assume as a matter of course that power must be continuous and first class in every respect all the time and that a strict accounting must be given for every second when, for any reason, the 100 per cent standard is not maintained. Such an analysis will inevitably include a study of the original cause of each disturbance, of the various secondary events, the functioning of relays and other automatic devices, the manipulations carried out by attendants in response to the indications of switchboard instruments, and, lastly, a study of the ultimate effect of each disturbance on service. The natural consequence will be that all possible corrections of conditions responsible either for the original cause or for subsequent undesired secondary effects will be carried out, and that improved operating methods will be adopted that will reduce or eliminate the chances of such causes recurring.

*Excerpt from address before a joint meeting of the A. I. E. E., A. S. M. E., A. S. C. E. and A. I. M. M. E. at New York, March 21, 1923.

Under the standard adopted for the Holtwood-Baltimore-Lancaster system a total loss of load, be it for only a second, is classified as a total interruption; a partial loss of load, provided that it can be traced on the main station instruments, is classified as a partial interruption, and

TABLE I—SUMMARY OF SERVICE DISTURBANCES COMPARED FOR FIVE-YEAR PERIODS, 1913-1917 AND 1918-1922

Causes	Total Interruptions			Partial Interruptions			Voltage Disturbances		
	1911 and 1912	1913–1917 incl.	1918–1922 incl.	1911 and 1912	1913–1917 incl.	1918–1922 incl.	1911 and 1912	1913–1917 incl.	1918 1922 incl.
1 Ice	1	0	0	0	1	0	1	0	0
2 Breakdown of power-house equipment	3	1	0	5	2	1	2	19	2
3 Excitation system, regulators, etc.	0	1	0	0	1	0	5	23	7
4 Gates and governor system	0	0	0	0	0	0	15	6	1
5 Holtwood mistakes	2	5	1	4	7	1	12	35	20
Totals, 1 to 5	6	7	1	9	11	2	40	83	30
6 Lightning on transmission line	26	7	4	19	47	33	14	38	48
7 Brick on transmission line	1	2	0	0	3	0	0	12	5
8 Mechanical trouble on line (sleet)	0	5	0	0	9	0	0	14	7
9 Transmission-line mistakes	0	0	0	0	1	1	0	0	0
Totals, 6 to 9	27	14	4	19	60	34	14	64	60
10 Highlandtown equipment	0	0	3	0	0	1	0	0	5
11 Highlandtown mistakes	0	1	2	0	3	4	0	1	26
Totals, 10 and 11	0	1	5	0	3	5	0	1	31
12 Distribution system and customers' equipment	6	4	1	21	134	238	1	74	273
13 Overload	0	0	0	0	0	0	6	18	63
14 Lancaster system	0	0	0	0	0	0	0	36	65
15 Miscellaneous	2	0	0	0	1	0	4	3	9
16 Tests	3	3	0	3	5	11	3	26	114
17 Man in contact with line conductor	2	1	0	1	2	0	0	0	1
Totals, 12 to 17	13	8	1	25	142	249	14	157	525
Totals, 1 to 17	46	30	11	53	216	290	68	305	646
Location of trouble									
Holtwood power house	6	10	1	4	8	2	45	109	39
Baltimore high-tension line	27	15	4	19	58	34	14	65	61
Highlandtown substation	5	2	5	1	6	6	5	2	37
Baltimore distribution system, including customers' equipment	8	3	1	29	141	250	4	94	446
Lancaster system	0	0	0	0	3	0	0	37	65
Unknown	0	0	0	0	0	0	0	0	1
Totals	46	30	11	53	216	*292	68	305	*649
System of original trouble									
Pennsylvania Water & Power Co.	39	27	10	29	95	59	65	182	155
United Railways Company's system	3	0	0	5	28	37	1	17	32
Consolidated Gas, Electric Light & Power Co.'s system	4	3	1	19	90	210	2	69	396
Lancaster Edison Co.'s system	0	0	0	0	3	0	0	37	65
Unknown	0	0	0	0	0	0	0	0	1
Totals	46	30	11	53	216	*306	68	305	*649

* Figures do not check on account of some being classified in two places.

TABLE II—DISTURBANCES DURING 1922 CLASSIFIED ACCORDING TO CAUSE AND EFFECT ON SERVICE

Effect on Service	Causes											
	Ice	Breakdown of Mechanical Equipment	Breakdown of Electrical Equipment	Lightning	Sleet	* Accidental Interference.	Mistakes	Overload	Tests	Miscellaneous	Unknown	Totals
Trouble which interferes with generating ability—but no disturbance			4			1						5
Relay action on 25-cycle system, frequency disturbance, voltage disturbance; no load lost		2	9	26		4	7		4	2		64
Relay action on feeder in trouble; no load lost			16	3		1	1	1				12
Low-voltage releases tripping; no load lost												0
Additional primary relay action; no load lost			2									2
Separation and out-of-step condition; no load lost										1		-
Small load lost due to intentional reduction, by orders or by switching		2										2
Small load lost on feeder in trouble			18	17		5	1					41
Small load lost due to low-voltage releases tripping			13	3		1	1		3			21
Small load lost due to additional primary relay action			7	1		3						11
Small load lost due to separation and out-of-step condition			1	1		2						4
Moderate load lost due to intentional reduction, by orders or by switching												1
Moderate load lost on feeder in trouble			2	1		2						5
Moderate load lost due to low-voltage releases tripping							1					1
Moderate load lost due to additional primary relay action			2	2								4
Moderate load lost due to separation and out-of-step condition				1		1						2
Large load lost due to intentional reduction, by orders or by switching												0
Large load lost on feeder in trouble				1								1
Large load lost due to low-voltage releases tripping			1									1
Large load lost due to additional primary relay action												0
Large load lost due to separation and out-of-step condition												0
Total interruption of less than five minutes												0
Total interruption of five minutes or more												0
Total	0	4	75	57	0	20	12	1	7	3	0	179

*Wind, flood, men, heat, cold, moisture, tools, trees, birds, other animals, kite strings, etc.

irregularities in voltage or frequency exceeding 4 per cent in voltage and 2 per cent in frequency are classified as disturbances, although no visible loss of load can be traced on the graphic wattmeters.

The statistics (Table I) illustrate more convincingly than can be done by general statements that hydroelectric plant troubles as such—i.e., causes numbered 1 to 5 on the tabulation—ceased to be the cause of interruption after a few years, although they were responsible for a few serious disturbances during the early period of operation at Holtwood. For example, ice caused a complete shutdown in 1912, about one year after commencing operation. Up to that time the general belief was that a plant built almost at the Mason-Dixon line with a storage lake 9 miles long would be immune from frazil ice. The tabulation shows only one other instance of trouble from this cause (in 1914), and in this case frazil ice was combined with ordinary ice. Only a partial reduction in service resulted. All the other sources of trouble at the hydraulic plant (causes 2 to 5) show a similar tendency to disappear.

Lightning in the first year of operation, 1911, caused twenty-three total interruptions of a few seconds or a minute each, none of them causing any permanent disabling of the line. Chiefly because of the use of the Nicholson arc extinguisher, this number was reduced in the following year, 1912, to three; in the next five-year period these interruptions were reduced to an average of 1.4, and in the last five years to an average of 0.8. There have been no interruptions during the past three years.

Distribution trouble, chiefly that originating on the city distribution system and at the interconnected steam plants, shows a trend in the opposite direction, at least as regards partial interruptions. The number of partial interruptions from this cause rose to 238 in the past five years from a total of 134 during the preceding five-year period. Minor disturbances to voltage and frequency have increased to 273 from 74. This condition has caused the operating engineers to concentrate their studies in more recent years on the distribution problem as the principal field for possible service improvements. This study has been aided by means of a detailed tabulation (Table II) where disturbances are classified as to cause and effect on service.

F. A. ALLNER,
General Superintendent.
Pennsylvania Water & Power Company,
Baltimore, Md.

Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Commutator and Brush Operation

BRUSHES should be so fitted to the commutator that the entire brush surface is effective, thereby reducing heating of the brushes or any tendency to spark caused by improper contact. The spring tension on the brush should be sufficient to prevent chattering and to make proper contact with the commutator, but not sufficient to cause undue friction between the brushes and commutator. Care must be exercised not to apply too large a quantity of lubricants, as this, while it may reduce friction, will cause poor contact.

The commutator of the machines should be wiped off frequently to remove the dirt, which in a short time would cut the commutator surface. As occasion demands, especially when sparking is caused by a very dirty commutator, the commutator may be cleaned by using very fine sandpaper and then wiped clean with a rag. With slip rings the same precautions must be taken as with commutators to prevent cutting of the surfaces by the brushes and also to insure good contact between the surface and the brushes.

The following rules applying to commutators, brushes and slip rings have been abstracted from the operating code of the Philadelphia Electric Company:

COMMUTATOR AND BRUSHES

1. If machines are installed in dusty, dirty or poorly ventilated places, the commutator should be wiped every half hour. When machines are in more favorable places, this time may be extended to two or even three hours.

2. Lubricant consisting of commutator oil is to be used once every half hour to every two hours on commutators having copper brushes. In no other case is a lubricant of any kind to be used. However, if the commutator shows a tendency to cut, this may be stopped by cleaning once every half hour or hour with paraffine. Paraffine should not be allowed to remain, but should be wiped from the commutator immediately after it has been applied. Both paraffine and lubricant should be used sparingly. For cleaning the commutator or applying lubricant a standard commutator stick should be used. No lubricant is to be used on slotted commutators under any circumstances.

3. On machines equipped with brush-shifting mechanism adjust the brush position to give minimum sparking.

4. Brushes which have stuck in the holders may be loosened, or dirt may be removed, but in making these adjustments while the machine is running the brush must never be entirely removed from the holder.

SLIP RINGS

1. Do not use lubricants or wipe the rings where they are made of brass or steel and the brushes are either carbon or a graphite-copper alloy.

2. Where oil from adjacent bearings is thrown on slip rings, they should be wiped once every one hour or two hours with a standard wiping stick.

3. If there is a tendency to cut, a slightly oiled instead of a dry cloth may be used on the stick for wiping.

4. If the rings are brass and the brushes leaf copper, commutator oil or vaseline should be used for lubricating once every hour.

Boring Boiler Tubes

WHEN boring boiler tubes care must be taken not to allow the boring machine to remain at any one place, as it will cut the metal and weaken the tube. First of all, the boiler should be taken off the line, following the rules published on page 811 of the April 7 issue of the ELECTRICAL WORLD. The rules given below for boring tubes, taken from the operating code of the Philadelphia Electric Company, should then be followed:

1. When the scale can be removed with the cone cutter, the hammer must not be used.

2. See that the mud drum is open, and remove at least one cap from the back header.

3. Block the blow-off pipes at the mud drum to prevent scale from going into the blow-off piping.

4. Insert the machine in the end of the tube before starting.

5. Signal the helper operating the air valve to turn on the air.

6. After the machine has started, feed it slowly into the tube and do not allow it to remain stationary at any point.

7. After the machine has entered about one foot, water should be fed into the tube behind the machine.

8. If hard scale is encountered, preventing the machine from being fed through at uniform speed, the machine should be drawn backward and fed forward again until the obstruction is removed; the machine must not be allowed to remain cutting at one spot.

9. Repeat the operation until the tube is bored to gage.

10. Oil the boring machine after boring every four tubes.

11. After all the tubes have been bored to gage, wash out the tubes with water.

12. Remove the scale from the mud drum.

Cost of Installing Street-Lighting Equipment

DURING 1922 a Massachusetts central-station company added 223 series brackets, eighty-four ornamental posts, twenty-nine mast arms and incidentals to its street-lighting equipment, at a total cost, including transportation and labor, of $14,309. From the work sheets of the company the accompanying tabulation of these costs is printed, with unit prices met by the utility.

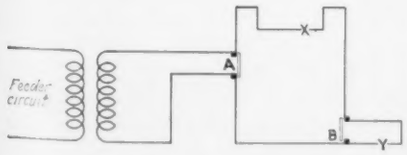
STREET-LIGHTING EQUIPMENT COSTS FOR 1922

Items	No. of Units	Price per Unit	Totals
Series brackets	223	$9.807	$2,187
Series brackets less hoods	139	1.977	275
Span suspensions	4	14.092	56
"Jupiter" cut-outs	27	14.020	378
"Novalux" fixtures	69	12.530	865
"Bishop" fixtures	144	14.538	2,093
Cut-outs	13	10.108	131
"J134Y" cut-outs	32	12.588	403
"Bishop" crook brackets	21	4.105	86
"Form 10" fixtures	20	10.864	217
Ornamental posts	84	37.594	3,158
Brady mast arms	29	16.781	487
Miscellaneous material, bolts, insulators	...	.....	1,781
Teaming	...	.....	27
Street-light location cards	...	.....	23
Making wrenches	...	.....	5
Miscellaneous small items	...	.....	5
Transportation by utility company	...	.....	311
Payroll labor	...	.....	1,821
Total (cents omitted)	...	.....	$14,309

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Locating Open Circuit on Series Systems

THE problem of quickly locating open circuits on series systems due to broken lamps or trouble on current transformers has always been a bugbear, but the method used on the writer's lines has reduced the time thus lost considerably. Assuming that the lines are laid out as shown in the diagram, fuse blocks with the jacks left out are connected at places *A* and *B*. The jacks are not fused but are strapped across with a piece of copper wire and are left out unless an open circuit is being hunted. Should there be an open circuit somewhere on the line, say at *X*, the "trouble shooter" can go directly to *A* and insert his jack. If the circuit is closed to his left, all the lamps will be burning and this will indicate that the open circuit is further along the line. He then travels to *B* and repeats the operation. If the lamps do not burn, he knows that his open circuit is behind him; but should there be an open circuit as shown at *Y*, all the lamps to his left will be burning, and this will indicate that the open circuit is on the one remaining section of the line.



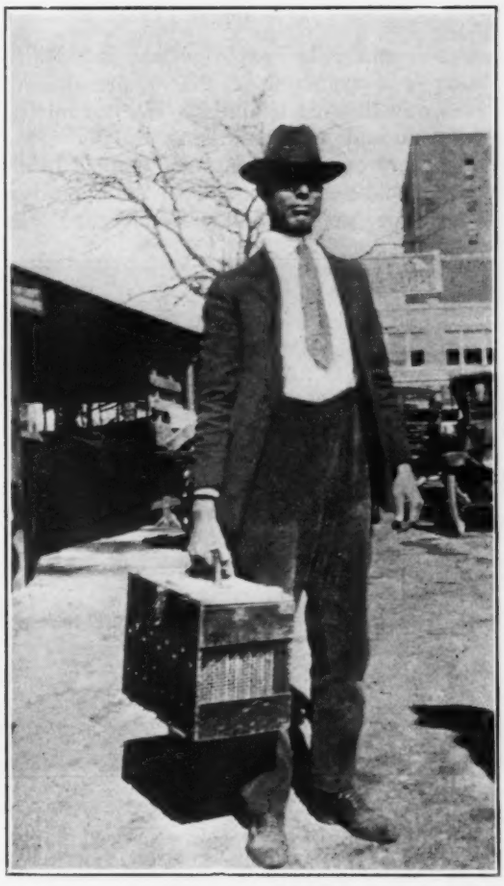
JACK PERMITS LOCATING OPEN CIRCUIT IN SERIES SYSTEMS

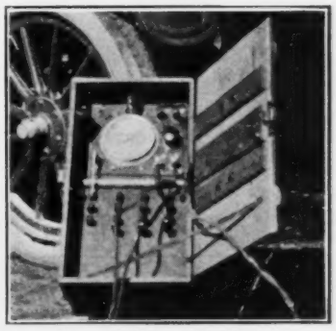
Inserting jack *A* or *B* in the fuse blocks furnishes current for all but one section while the trouble is repaired along the line.

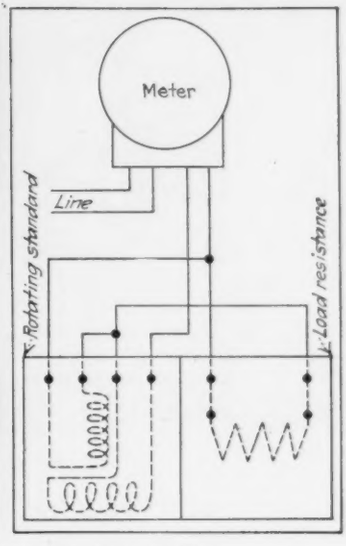
This method of completing the circuit prevents an entire district of the town being without lights because there is an open circuit in one small section, since the jack can be left in position, thereby furnishing current to the rest of the system until the open circuit at *Y* has been fixed.

RAYMOND H. FORKNER,
General Manager.
Madisonville Light & Power Company,
Madisonville, Tenn.

Rotating Standard Combined with Load Resistance







COMBINED TEST SET THAT HAS PROVED VERY SATISFACTORY

Left—Rotating standard and resistance load mounted in box conveniently arranged for carrying.

Upper right—Box opened, showing combined set.

Lower right—Diagram showing how meter is connected to throw the shunt loss on both the standard and the meter under test. This arrangement has worked out very satisfactorily.

BY MOUNTING a rotating standard watt-hour meter and load resistor in a box arranged for convenient carrying meter testers of the San Antonio (Tex.) Public Service Company have averaged as high as forty tests a day. Two views of this box are shown above.

The connections are all permanent so that no time is lost on the job. All that is necessary is to replace the two load wires of the customer's meter with those of the box and then proceed with the test. The wiring diagram shows how the standard is connected so that the shunt loss of the meter is measured on both the standard and the meter under test. The box complete with tools and wiring weighs 35 lb. The box and circuit were developed by Grover Lee of this company and after several months' service have proved satisfactory and a great improvement over the system of separate load and standard.

H. T. POWELL,
Meter Department.
San Antonio Public Service Company,
San Antonio, Tex.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Appliance Selling in Small Communities

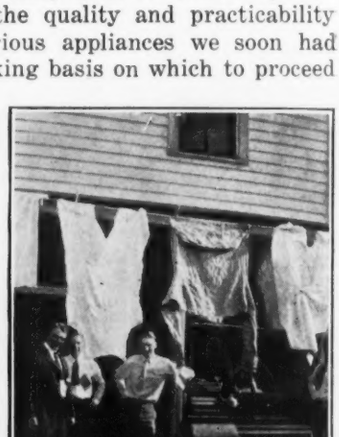
How One Central-Station Company, Serving Sixty-four Cities and Towns, Has Organized and Operated a Selling Staff and Put the Merchandising Business on Its Feet

By P. D. Kline
Vice-President Wisconsin-Minnesota Light & Power Company, Eau Claire, Wis.

CENTRAL-STATION companies that are facing today the problem of organizing and developing the market for electrical appliances among smaller communities may perhaps find something of interest in the recent experience of the Wisconsin-Minnesota Light & Power Company. This company serves sixty-four communities in the region lying to the east of St. Paul and Minneapolis. The principal towns and their population are: LaCrosse, 35,000; Eau Claire, 21,000; Winona, 21,000; Chippewa Falls, 11,000; Red Wing, 9,000; Sparta, 5,000; Rice Lake, 5,000, and Menomonie, 5,000. Headquarters are in Eau Claire, and several stations, both hydro-electric and steam, are interconnected in a loop. We maintain twenty district offices and serve a total population of 125,000.

Two years ago the merchandising of gas and electric appliances in this country was flat. Industries as well as the farmers in the surrounding community experienced bad times and transmitted that depression to all lines of business. We lost money in our merchandising during 1921, and our organization dwindled to almost nothing so far as the appliance sales department was concerned. In 1922 we, like many other organizations, decided that business was to be had if sufficient effort were put forth; therefore, even though it was necessary for us to start from the bottom to build up a sales organization and develop an appliance sales business, we set about doing that thing. Price cutting had been indulged in and war-time appliances got into the hands of the consumers with a good deal of grief and dissatisfaction as a result. We, therefore, realized that we had these conditions to live down and overcome.

At the very outset, therefore, we set about to do two things—to make a complete survey of all of the appliances then in use in the homes of our customers in order to obtain an idea of the field before us, and to test out the different lines of appliances offered by the market, aiming to eliminate unworthy goods and thereby re-establish quality and price level based upon quality merchandise. To accomplish this, we made a careful house-to-house survey of the customers in the principal towns, and by calling meetings of the managers of the various districts and getting their combined opinion upon the quality and practicability of various appliances we soon had a working basis on which to proceed with the building of our merchandising business.



AT LEFT—SALESROOM IN THE LA CROSSE OFFICE. AT RIGHT—AN OUTDOOR DEMONSTRATION IN BLAIR

We procured a number of good salesmen, schooled them, and then started to do business. We began to run campaigns, covering first one appliance and then another, supporting each of these campaigns by dealer helps, newspaper advertising, window displays and special price, offering an inducement as the character of the appliance indicated that such inducement would be a sales help. We tried particularly to impress upon our men the importance of calling back on every customer, and while it has been difficult to have this idea carried out in a 100 per cent manner, we are improving continually and the salesmen are realizing more and more the

AT LEFT—ANOTHER VIEW OF THE BLAIR DISPLAY. AT RIGHT—A WINDOW IN SPARTA

value of a satisfied customer. Based upon our survey, which indicated that the present saturation of the more common appliances, such as the washer, cleaner, flatiron, toaster, and so on, was approximately 25 per cent, it was seen that if we could increase this saturation to a 75 per cent point, it would result in an increase of revenue amounting to about $300,000 per year, showing conclusively that we had a goal and that it was worth strenuous effort to reach.

We then worked out a sales bogey, or quota, for each district and advised the district manager of the amount of his bogey, which constituted the net sales that he was expected to realize to keep up his portion of the total amount anticipated as the year's business.

Placing the Staff

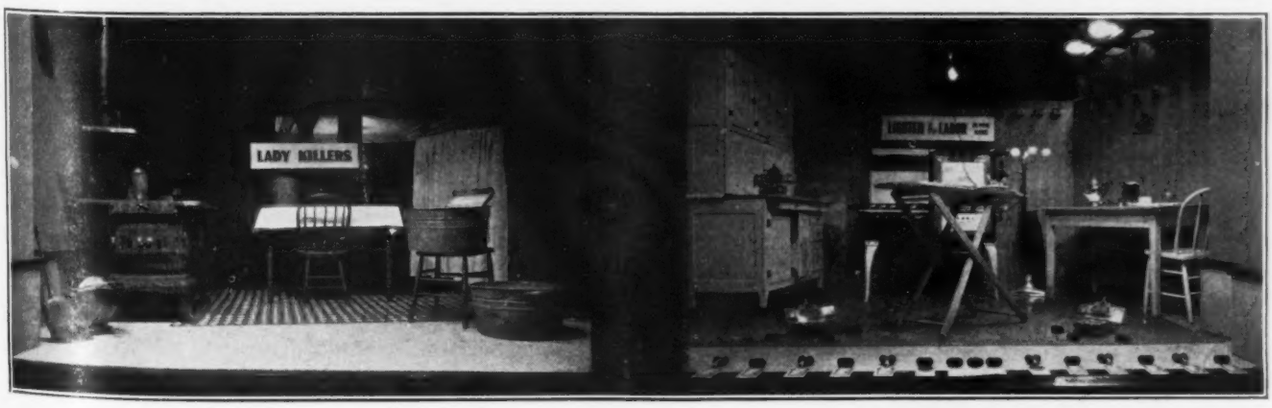
We built up our selling staff until it numbered fourteen men, all established in the larger towns and doing general selling. In addition, we have one expert industrial engineer who helps on big jobs. We figure roughly that from 5,000 to 6,000 population will support one salesman. We group the smaller towns with larger ones to make a territory, because four or five towns of 1,000 inhabitants can be made to produce business no less than one town of 5,000. In the large towns and many of the small ones we have an office. Girls are employed to sell on the floor. All the towns are working along standard lines as to price and policies, and we are impressing on all our people that they must not fear price competition, that our prices are right for our quality and that our quality is right for our customers.

We are trying also the experiment of employing a few middle-aged men and some women for outside selling, believing that they can call at the homes and get a more considerate reception than might be accorded to young men. So far the plan is working out well. These salespeople make fewer calls, but seem to be able to tell their story better and to get results.

We had, of course, worked out a compensation plan for the salesmen, some of whom were paid on the basis of $100 per month and a 10 per cent commission on all sales over $1,200 per month; others were paid on a straight 10 per cent commission covering all sales, while still others were placed on the basis of $100 per month drawing account and 10 per cent on all sales. If any man goes below $1,000 per month for three consecutive months, we feel that he is not doing a satisfactory business, and he is replaced. In addition to the commission on sales, a bonus was paid for all new services, either gas or electric, procured by the salesmen, and a bonus was paid for all appliance "prospects" turned in by any member of the organization if the "prospect" resulted in a sale. This bonus, however, was paid only where the new customer had not been canvassed by a salesman previous to the time that the name was turned into the commercial department.

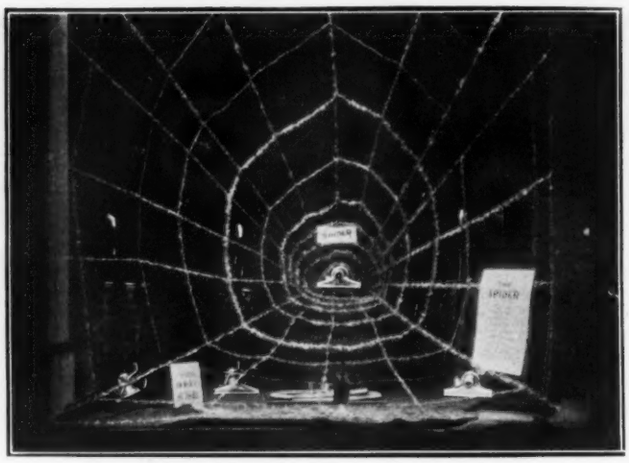
Selling on Trial

We have a large foreign-born population—German in La Crosse, Norwegian around Eau Claire. The easy payment seems to appeal to them, and we have no difficulty in collecting. We demonstrate appliances freely and leave them on trial in many cases. The Norwegians are very heavy coffee drinkers and we anticipated a large sale of percolators, but to our surprise found it almost impossible to interest them. They are accustomed to keeping a pot of coffee boiling on the stove all the time and to drink it strong, and they will not make it the electric way.



AN EAU CLAIRE WINDOW DISPLAY FEATURING LADY KILLERS VERSUS ELECTRICAL EQUIPMENT

This is just a little sidelight on the way that local influences sometimes affect the appliance market. In our effort to re-establish "quality" merchandise in the cities we serve we have tried in every case, in adopting an appliance, to secure the same price and profit for one or more dealers in the town, and then we have advertised their names along with ours. Salesmen of competitive brands have naturally complained, saying that we have bottled up the towns; but we believe that the public is benefited by the elimination of riffraff appliances and that the dealers are benefited by having an established market and a sure profit.



AN UNUSUAL CLEANER WINDOW IN EAU CLAIRE

WIRING BUSINESS

We have supported the contractors well in wiring also. In some small communities where there is no city inspection and the wiring has not been up to code, and where it has been found impossible to raise the standard of wiring through suggestion in the public interest, the company has gone into the wiring of houses itself. But this has been entirely conditional on the kind of job the local contractors were doing. In larger towns in co-operation with the contractors we have developed a flat-rate wiring schedule based on a price per outlet and are actively selling wiring which the contractors install, paying a commission to our salesmen no matter who wires the house. At the present time we have about 24,500 residence meters in service. Last year approximately 700 houses were wired. We are trying to influence the installation of more convenience outlets and are working with the architects and builders to try to "sell" the idea.

All our salesmen are working continually on both store and window lighting, and we have installed some colored lamps and with good results. The power field is limited, but we are constantly after the blacksmith shops, condensories, creameries, machine shops, garages and so on.

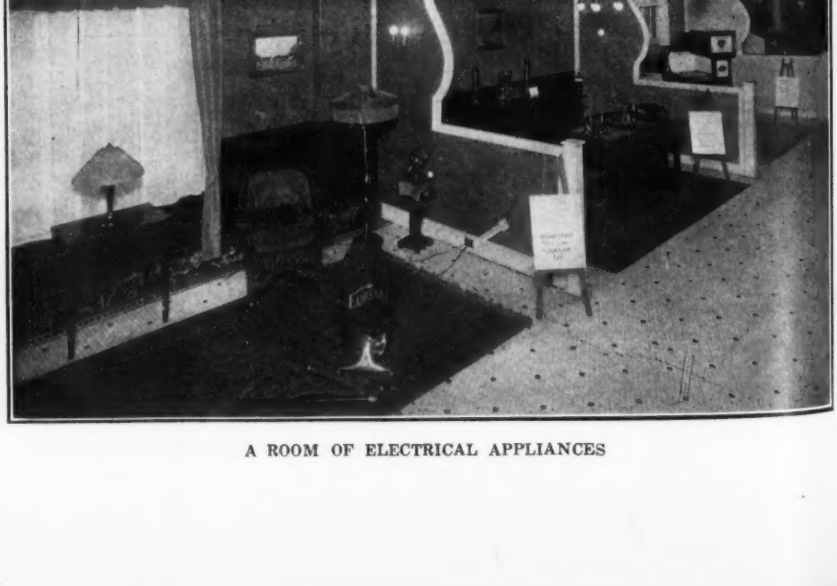
We have done a considerable amount of advertising in local papers and direct by mail and have made a feature of our store-window displays and demonstrations. The purpose in it all, however, has been primarily to sell the idea of the quality of electrical goods and the importance of the central station to the community. Our own organization is thoroughly imbued with this point of view. We tell our customers that if an appliance is broken it should not be put on a shelf but brought to us. We try to keep every appliance in use. We have run a school of home economics in five of our larger towns and have given many lectures and talks before Kiwanis and Rotary clubs and shown a motion-picture film showing our plant and construction. In one of our offices we are setting up a model kitchen and laundry.

In fact, in the small communities we are serving we realize that we have the same fundamental social structure that exists in the big cities. We have families living in houses, and no matter where families live they have the same general desires and needs. Thus we have simply gone to work to try to satisfy those needs and develop those desires through education in so far as the comforts, conveniences and utilities of electric service are concerned.

While it is true that our plan has not materialized to the 100 per cent point, the close of 1922 found the commercial department self-sustaining with a small profit as compared with a deficit in the previous year, and the first four months of 1923 have shown approximately double the volume of the same period a year ago; therefore, we conclude that our efforts have produced some result, that by the experience of the past year we are going to profit materially during this year, and that our consumers are likewise going to profit by maintaining and following out a sales plan which embodies "quality" merchandise and service.

A Practical Layout of Electrical Home Needs

THE Utah Power & Light Company has adopted this very pleasing and effective way of displaying electrical appliances for the home. The south wall of the company's large electric store in Salt Lake City has been partitioned into three rooms —a living room, a dining room and a kitchen—representing an electrically equipped home. These rooms are not "overdone" with electrical appliances, but each contains equipment appropriate to the use of the modern housewife. The display is attractively arranged and receives the attention of most of the people who enter the company's electric store.



A ROOM OF ELECTRICAL APPLIANCES

"Business Builder" Helps Employees' Interest

BY A. M. FROST
Manager of Sales San Joaquin Light & Power Corporation, Fresno, Cal.

IT IS the intention of the San Joaquin Light & Power Corporation to make every employee of the company a salesman and a reporter of complaints. A blank book, the "Business Builder," has been issued to every member of the operating force, and in circular letters and meetings all have been instructed how to use the books. The line cut shows a sheet out of one of the books, on the cover of which the following instructions are printed:

With this book you can render valuable assistance to the management in improving our service and building our business.

If you hear of a complaint about service, make out a form and scratch out the line "Is interested in."

If you hear of a prospect for additional load or appliance sales, make out a form, scratching out the line "Complains of."

Turn in to manager of your district through your department head.

Fill out the stub for your record. A report will be made to you about each form you turn in.

I thank you for your co-operation.

A. M. FROST, Manager of Sales.

Each district manager is charged with the responsibility of seeing that the employees use these books. In adopting this practice the company is going on the theory that every employee has a great many friends and personal acquaintances who look upon him as a representative of the power company. The use of the book enables employees to report complaints they hear of and to turn in prospects for additional business. It has been found that meter readers, collectors, linemen and office employees are all in a position to use the "Business Builders" to the advantage of the company as well as to their own advancement. The company hopes to be able to recruit salesmen from within the organization, and the use of these forms will give a line on good men by the number of reports turned in and the intelligence with which they are used.

During the short time the system has been in use it has produced satisfactory results. Employees who are not actually engaged in sales work feel that through the use of these books they have been given some part in the devolopment of the company's business and its management. The plan will not only conduce to harmonious public relations but will actually help in increasing the company's earnings.

Form 2149

Name _____

Address _____

Complains of
Interested in _____

_____

_____

Date _____

SAN JOAQUIN LIGHT & POWER CORPORATION
BUSINESS BUILDER

Name _____ District _____

Address _____

Complains of
Is interested in _____

_____

_____

Date _____ Signed _____ Dept. _____

BLANK AND STUB ON WHICH EMPLOYEES REPORT PROSPECTS OR COMPLAINTS

Illinois Company's Sales Show Big Gain

THE income to be derived from the sale of appliances by public utility companies and the extent to which this branch of the business can be developed is strikingly illustrated by the accompanying tabulation of the sales of the Central Illinois Public Service Company of Springfield for the first four months of this year as compared with the same months of the year previous.

GAIN IN CENTRAL ILLINOIS COMPANY'S SALES

	1922	1923	Increase in Sales	Per Cent Increase
Jan.	$18,953.15	$24,907.92	$5,954.77	31.4
Feb.	14,260.46	32,537.56	18,277.10	128.1
March	19,297.46	33,242.00	13,944.54	72.0
April	20,060.90	39,647.77	19,586.59	97.5
Total.	$72,571.97	$130,335.25	$57,763.28	80

While this remarkable increase in sales can be attributed partly to improved business conditions and to the increasing popularity of electrical devices, it is none the less true that the principal contributing factor to the increase has been the intensive effort made to develop this branch of the business.

As indicative of the class of appliances sold during one week, the sales included twenty-one vacuum cleaners, ninety-one irons, nine electric ranges, thirty-six washing machines, four sets of fixtures, four motors and eight fans. These, with other miscellaneous items, represented sales for the week to the value of $12,279.

What Other Companies Are Doing

Seattle, Wash.—The Puget Sound Power & Light Company is issuing an illustrated handbook, primarily for the use and information of employees interested in the sale of company securities. A number of copies are going into the hands of the public and will provide those of an inquiring mind with the facts that will go far toward removing any prejudice they may have against the company.

Worcester, Mass.—A motor installation of about 4,000 hp. rating is planned as a means of reducing steam-power costs at the local mills of the American Steel & Wire Company, a subsidiary of the United States Steel Corporation. Power will be supplied by the New England Power Company. Hugo Rocktashel is commercial manager.

Pine Bluff, Ark. — On April 24 the Rotary Club of Pine Bluff turned over its luncheon to the Arkansas Light & Power Company. William Crooks, chief engineer, and C. S. Lynch, purchasing agent, presented a graphic story of their organization by the use of an electrical map showing the value of interconnection with their three generating plants. The Arkansas company now has 1,000 stockholders, and the Pine Bluff company has 350, of whom 150 are residents of Pine Bluff.

Lake Geneva, Wis.—Seventy-two people composed of executives and employees of the Southern Wisconsin Power Company and local newspaper men were guests at a banquet tendered by the company to its employees on the occasion of their regular monthly meeting for May. Employees gathered here from the various sections served by the company. The principal address was given by W. S. Vivian, public relations superintendent of the Middle West Power Company, Chicago, who spoke on the promotion of better public relations between public utility companies and the public through the medium of the greatest point of direct contact, the employees.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Generation, Control, Switching and Protection

Mechanical Forces in Knife Switches. —O. EDELMANN. — For the proper design of a mechanical testing machine for knife switches it became necessary to determine the pressures which occur during the regular closing and opening of such switches. As an average switch a double-pole 200-amp. model has been chosen. More than two-thousand tests were made with twenty-two operators, of various heights, with the switch mounted at five different heights. The results were tabulated and give valuable information for the design of such switches from the purely mechanical standpoint. — *Elektrotechnische Zeitschrift*, March 29, 1923.

Hydro-Electric Development and Steam Equipment

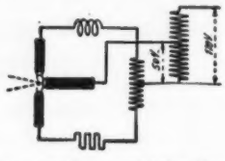
Boiler Furnace Design. — E. B. RICKETTS.—The author considers the factors governing furnace volume and construction of boiler-furnace walls, discussing types of fuel-burning equipment, pulverized-fuel systems, shape of combustion chamber, mixing arrangements, etc. He holds that there is a tendency in modern power stations toward larger combustion space.—*Mechanical Engineering*, May, 1923.

Water Power in Netherlands East India.—In a territory about one-fifth the size of the United States, with approximately fifty million inhabitants, a large number of small rivers offer many opportunities for hydro-electric development. A total theoretical capacity of 757,000 hp. was found on the island of Java. A report on Sumatra shows a possible development of 250,000 hp. on the Asahan River.—*Fourth annual report of the Government Service for Water Power and Electricity, Netherlands East India.*

Hydro-Electric Power on the River Bès, in France.—G. LEFÈVRE.—The author gives an interesting account of the equipment of a 12,000-kva. hydro-electric power station which supplies an electrometallurgical plant manufacturing iron alloys. Three Francis-type turbines of 4,600 hp. each operate under a head of 144 m. and drive 4,000-kva., three-phase, 50-cycle generators at 630 r.p.m. Two separate 120-kw. excitation sets, driven by two auxiliary Pelton-type turbines and a storage battery, furnish the field current for the generators. The machine voltage is stepped up in three 4,000-kva. oil-insulated and water-cooled transformers from 8,200 to 30,000. A double transmission line of about 10 miles, using reinforced-concrete poles entirely, connects the station to the smelting plant. Three step-down transformers, identical with those in the power station, reduce the incoming voltage again to 8,200, and to these buses are connected three banks of special water-cooled furnace transformers, each bank consisting of three 1,250-kva., single-phase machines with a ratio of 8,200 to 60/120 volts and taps for ± 11 per cent regulation. There are at present five single-phase, 1,000-kw. furnaces, three three-phase, 3,000-kw. furnaces and one rocking furnace in operation.—*Revue Générale de l'Electricité*, April 21, 1923.

Illumination

Alternating-Current Projection Arc Lamps.—B. SCHÄFER.—An arc lamp for motion-picture projectors is described. The author uses a combination of three carbon electrodes, two arranged vertically, one above the other, and a third horizontally. With the aid of a resistor and an iron-core choke coil the two vertical electrodes receive almost 90 deg. phase displaced current, so that



THREE-ELECTRODE LAMP SAID TO GIVE OVER TWICE THE LIGHT OF ORDINARY ARC LAMP

the time intervals, during which the light emission is almost zero, are much shorter than with an ordinary two-electrode arc lamp. This avoids any possible interference between the light of the lamp and the speed of the projector shutter. The light output is greatly increased. For a lamp current of 32 amp. a two-carbon type gives 600 cp., while it is claimed that the three-electrode lamp measures 1,400 cp. Practical tests with this lamp in a motion-picture theater gave a very satisfactory performance. — *Elektrotechnische Zeitschrift*, April 12, 1923.

Transmission, Substations and Distribution

High-Voltage Submarine Cable in Norway.—F. HANFF.—To supply fourteen small islands off the Norwegian coast with energy from the power station in Aalesund a large number of cables had to be laid out to connect these islands. The individual lengths of the cable pieces varied from 3,000 m. to 500 m., and the depth of the sea ranged between 10 m. and 360 m. Three-phase cables were designed for 22,000 volts and have a copper cross-section of 3 mm. x 25 mm. or even 3 mm. x 50 mm. The lead sheath is 4 mm. thick and is armored with an outer layer of galvanized-steel wires. The total length of all the cable laid was 30 km., with a weight of 653 tons. No joints under water were permitted, and for each stretch between two islands the proper length of cable was manufactured in one piece. Before shipment each cable was tested with 55,000-volt alternating current and after laying each length was again tested with 85,000-volt direct current for one-half hour. Including all auxiliary work, such as making all pothead connections on land and testing, the entire undertaking was accomplished in twenty-eight calendar days. The article contains a very interesting and detailed account of the many difficulties encountered during this unusual work.—*Siemens Zeitschrift*, April, 1923.

Endangering of the Bare Direct-Current Neutral. — C. MICHALKE. — A detailed account of the relative advantages and disadvantages of various methods employed to counteract chemical and electrolytical effects upon direct-current neutral conductors laid under ground without insulation. The paper compiles the answers from a questionnaire sent out to a great number of direct-current plants. The great importance of the proper choice of the conductor and its surroundings, depending upon the chemical nature of the soil and possible stray currents, is emphasized and illustrated from practical experiences. — *Elektrotechnische Zeitschrift*, April 12, 1923.

Automatic Substations.—L. C. GRANT. —The author describes the functions of the control apparatus in automatic operation as applied to substations in England and gives some interesting features of cost.—*Electrician (London)*, April 20, 1923.

Motors and Control

Large Blooming-Mill Drive. — A. HARTMANN.—A heavy reversing mill drive is described that is used primarily for the production of 47-kg./m. grooved street-railway rails. It consists of a direct-current double motor and the necessary starting machines. The rating of the motor is 13,250-kw. maximum output at 0 to 60 to 150 r.p.m. in either direction with a maximum torque of 215 meter-tons. Accelerating each time to full speed, the motor can be started, stopped and reversed twenty times per minute. Ingots weighing 2,860 kg. are rolled with twenty-one passes into a rail of 47 kg./m., representing an elongation of thirty-three times. The starting set comprises two symmetrical halves, each with one three-phase induction motor of 2,100 kw. at 6,000 volts (50 cycles), two direct-current generators each of 1,560 kw. at 460 volts, and one 30-ton flywheel. The set revolves at 750 r.p.m. The flywheels are of cast steel and reach the rather high peripheral speed of 141 m./sec. To minimize windage loss they are inclosed in snug-fitting sheet-iron casings. A water-cooled brake with wooden shoes, capable of stopping the converter within six minutes, can be brought into operation. The mill

motor is driven with two or three of the direct-current generators in series, using Leonard connection. The speed regulation from 0 r.p.m. to 60 r.p.m. is obtained by changing the voltage of the starting generators, while from 60 r.p.m. to 150 r.p.m. the field of the motor itself is weakened. This rolling set has a capacity of up to 75 tons of rails per hour.—*Brown-Boveri Mitteilungen*, May, 1923.

Types of Motor Protection.—GORDON FOX.—The author considers location of protective devices, National Electrical Code revisions, undervoltage protection, time-element features, phase-failure protection, shunt-field relays, limit switches and overspeed trips and interlocks.—*Power*, May 8, 1923.

Winding Two-Phase and Three-Phase Induction Motors.—A. C. ROE.—The author gives practical details and tables for laying out unequal groupings of coils in induction motors having from four to forty-eight coils, two-phase or three-phase. The article gives the reader a clear insight into the possibilities of unequal grouping and an understanding of balance in a winding.—*Industrial Engineer*, May, 1923.

Electrical Equipment in Wire Mills.—J. E. MCDONALD.—Several new and interesting installations in the rod-rolling and wire-drawing industries are encountered in the new mills of the Whitaker-Glessner Company at Portsmouth, Ohio. Among these are the automatic coiling and conveying systems, slow start for motor-driven wire blocks, continuous wire-drawing machines and the applications of electric motor and control to practically all processes.—*Iron Age*, May 3, 1923.

Heat Applications and Material Handling

Electric Trucks. — A. CANAC. — A French concern is building storage-battery-driven electric trucks for which are claimed considerable advantages over existing American and English designs. Two 7.6-hp., 155-volt motors drive the rear wheels separately, obviating the otherwise required differential. Between each motor and its driven wheel is interposed, as the most conspicuous innovation of the truck, a reduction-gear case with a gear shift lever, similar to the apparatus used in gasoline cars. On level stretches of the road the normal running gear reduction is used between the pinion of the motor and the wheel, while on grades a higher reduction may be used. This will permit running the motors even on grades at the normal and most efficient speed and will also give a much quicker start of the truck up hill. Consequently a lower starting current will be taken from the battery and the motors will not tend to overheat. The lead-plate battery has a capacity of 250 amp.-hr., and is placed in two boxes of forty cells each. Loaded with five tons, the truck can make up to 20 km. per hour and consumes 0.6 kw.-hr. to 1.0 kw.-hr. per kilometer, or 0.12 kw.-hr. to 0.2 kw.-hr. battery-charging current per ton-kilometer. The fully loaded truck is able to climb grades of 12 per cent to 15 per cent at a speed of 4 km. to 5 km. per hour, at a consumption of 1.0 kw.-hr. per ton- kilometer. The radius of operation is 80 km. per charge.—*Revue Générale de l'Electricité*, April 14, 1923.

Electrophysics, Electrochemistry and Batteries

Effect of Electrodeposition of Nickel.—M. R. THOMPSON.—A number of previous investigations are reviewed, and it is concluded that the results may have been influenced by lack of regulation of the hydrogen ion concentration. It is shown that, if the hydrogen ion is properly controlled, the presence of iron in nickel solutions does not necessarily cause cracking or peeling of the deposits, as it has often been supposed to do. Deposited iron has a primary effect upon the crystalline structure of nickel deposits, rendering the latter finer-grained and therefore probably harder, although more brittle. Occluded basic precipitates containing iron may injure a deposit by making it porous or dark in color.—*Paper presented before American Electrochemical Society, New York*, May 3-5, 1923.

Traction

French Locomotives.—Two new types of direct-current, 1,350-volt locomotives were recently turned over to regular service on the Paris-Orléans and the Paris-Lyon-Mediterranée lines, and their electrical details are described in these issues. The "2-D-2" express locomotive is operated with a twin motor geared to each driving shaft, each motor designed for 675 volts. The hourly output of the engine is 2,400 hp., or 3,200 hp. for five minutes. A maximum level speed of 68 miles per hour can be reached. The tractive effort at the rim of the wheels at the hour rating and 31 m.p.h. is 28,600 lb. The over-all length of the engine is 65 ft. 7 in., and the weight complete is 110 tons (67 tons electrical equipment, 43 tons mechanical parts). Pantograph and third-rail collection is provided. The "D" type freight locomotives are equipped with a single-motor gear drive for each of the four shafts. All motors are built for operation on 1,350 volts. The hourly rating of the engine is 1,730 hp., with a tractive effort of 22,900 lb. at 28 miles per hour. The machines measure over all 40 ft. 8 in. and weigh 64 tons (35 tons electrical equipment, 29 tons mechanical parts).—*Bulletin Oerlikon*, February and March, 1923.

Extensive Electrified Railway System Proposed.—A permit from the Interstate Commerce Commission for a 1,307-mile electric railway system in Arizona, Colorado, New Mexico and California has been applied for. The article discusses sources of power, traffic to be handled, passenger service, methods of computing revenue and costs, construction schemes, locomotives, transmission systems, etc. Regenerative braking to utilize the potential energy of down-grade load to pull empty cars up the grade on the return trip is an interesting part of the proposal.—*Electric Traction*, April, 1923.

Telegraphy, Telephony, Radio and Signals

Measurement of the Electric Intensity of Received Radio Signals.—J. HOLLINGWORTH.—The first part of this paper is devoted to a discussion of some of the principles on which the measurement of received signals is based, and the practical application of these principles under working conditions is considered. The latter part describes a system recently developed at the National Physical Laboratory (England) which differs in several details from previous systems. Its operation is described in detail, and some of the possible sources of error and inaccuracy are considered.—*Journal of the Institute of (British) Electrical Engineers*, April, 1923.

High-Power Radio Station at Herzogstand. — Built primarily for experimental purposes, this Bavarian radio station has as the most striking feature an antenna which is stretched out between two mountain summits, the station itself being in the valley between. The free span of the five antenna wires, made of heavy steel cables, is 1½ miles, and the lowest point of it comes within 300 m. of the bottom of the valley. The anchor plant on one mountain top is solid, while on the other summit the wires go over a stationary pulley to a small car which can ride freely up or down a short inclined track. The car is loaded so as to give the antenna wires the proper amount of tension. The equipment of the station comprises one 200-kw. Poulsen-arc transmitter and one 200-kw. Schmidt high-frequency generator. It is expected to ascertain in this station the relative merits between these two methods of radio transmission.—*Zeitschrift des Vereines Deutscher Ingenieure*, April 11, 1923.

Miscellaneous

Standardized Electrical Machinery.—C. W. DRESCHER.—This paper describes in minutest detail the production of generators and motors on a large scale with such exact dimensions as to guarantee a perfect interchangeability of their parts. Whether it is a small ¼-watt motor or a 60,000-kw. machine, their shafts, bearings, etc., are produced with sufficient accuracy to insure a perfect fit if a new part is ordered to replace a worn-out one. Elaborate jig and caliber systems designed to carry on manufacturing on such a basis are described, and the influence of the method upon the design of the machine types is shown. In particular, examples are given of machines built by one concern which adopted such a system for the various departments in its plant.—*Elektrotechnische Zeitschrift*, May 3, 1923.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N.Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Boiler Feed, Measurement of Concentration of Salts in

A new conductivity cell has been developed for direct insertion into a boiler drum in order that the concentration of salts in a boiler may be easily determined. The cell may be safely used on pressures up to 300 lb. per sq.in. The electrodes are made of heavy nickel and the insulating structure is practically unbreakable. The concentration indicator used with the cells may be calibrated in total dissolved solids or chlorine content. The advantages of this new cell are the elimination of sampling and of extra piping.—*Instruments and Measurements Committee of the A. I. E. E.*

Circuit-Breaker, Oil, Large Resistance Bypass

Current-limiting reactors are coming more and more into use in this country on large systems to limit short-circuit current, thus protecting generators and limiting the duty of the oil switches. Abroad for the same purpose more and more are large bypass resistances used, which are built integral with the breaker and which by a combination of contacts are switched into the circuit before the opening occurs. One of the largest railroad companies in Europe and the firm of Brown-Boveri, Baden, Switzerland, made thorough tests on such breakers. The results obtained showed that with a resistance of four times the short-circuit impedance the duration of the arc is decreased to one-quarter, the energy liberated in terms of heat to one-tenth, the pressure produced during interruption to one-fifteenth, and the quantity of gas produced about to one-fifth of the values without resistance.—*G. Bruehlmann* (from *Brown-Boveri Mitteilungen*).

Drills, Electric, for Coal Mines

As a result of extensive tests, certain makes of electric drills have been approved for use in gaseous or dust-laden mines. The formal approval of these drills means that the bureau is convinced that if they should be inadvertently operated while immediately surrounded by an explosive mixture of gas or gas and coaldust, as the result of accidental interference with the ventilation or otherwise, the atmosphere surrounding the drill would not be ignited even though an explosion took place within the equipment.—*United States Bureau of Mines, Washington, D. C.*

Relay for Keeping Power Within Limits

A new induction-type relay has been produced, similar in appearance to an induction watt-hour meter, to indicate when the load exceeds or falls below a predetermined value. These relays are provided with two separate driving elements, each element having a current and a potential coil, which drive two disks mounted on a single vertical shaft. The shaft controls the operation of a set of double-throw contacts, which energize the coils of an auxiliary relay on over-power and short-circuit them on under power, thereby quickly and automatically relieving the main contacts of the relay of the burden of the circuit-breaker tripping current.—*General Electric Company, Schenectady, N. Y.* [Such relays should prove useful where power is sold or purchased on a demand basis, and also where a machine is to be started or stopped, depending upon the load conditions.—EDITOR.]

Short-Circuits in Power Networks

A miniature three-phase alternating-current generating and transmission system with adjustable resistance, reactance and capacitance units has been constructed and is used for the solution of various network problems, including those of short circuits. —*O. R. Schurig, Schenectady, N. Y.*

Transformers, Cooling of

A new system of cooling large oil-insulated transformers which must be operated in locations where an adequate supply of cooling water is not available. This system comprises a battery of radiators, installed either on the transformer or in a separate location, and in which the natural flow of oil between the transformer tank and the radiator is accelerated by the external application of low-pressure air currents in numerous small jets.—*General Electric Company, Schenectady, N. Y.*

Transformer Tests, Current, Lead Resistance in

To obtain accurate results employing current transformers for the measurement of large amounts of power supplied at high voltage, it is very essential that the transformers be tested when connected to a secondary circuit which is identical with or equivalent to the circuit with which they are used. It was found convenient by the calibrating laboratories of the Bureau of Standards to insert in the secondary circuits of the transformers an additional resistance (about equal to the actual resistance of the apparatus which would be installed in the particular installation) for a precise laboratory test.—*Bureau of Standards, Washington, D. C.*

In Progress or Purposed

Lightning Arresters for Low-Potential Circuits

Tests with steep wave fronts indicate (a) that a lightning arrester to be most efficient as a protective device should have a minimum impedance to flow of surge current so as to permit a very high current to flow at the instant of lightning discharge; (b) that it is apparently entirely possible to devise an arrester which will have a maximum potential across its terminals that will be less than the primary bushings and the primary windings of line transformers as now constructed for distribution voltages will withstand. It is confidently expected that arresters meeting this requirement will be produced by one or more manufacturers and available for general use within the next few years. When this result is achieved, then disturbances from lightning will be practically eliminated from our low potential distribution circuits.—*A. I. E. E. Sub-Committee on Lightning Arresters.*

Rope, Hoisting, Non-destructive Magnetic Tests on

It is proposed to prosecute the investigation along three general lines: (1) Laboratory study of the effect on the magnetic properties of the various factors which cause deterioration of a hoisting rope in service; (2) development of methods and instruments for magnetic tests under service conditions; (3) actual field tests to determine the possibility of practical application.—*R. L. Sanford, Bureau of Standards, Washington, D. C.*

Transmission Lines and Cables, Artificial

An investigation is being made which it is hoped will lead to the possibility of representing a power network artificially. The three-phase artificial line with distributed constants representing 110,000-volt practice with a length of 400 miles has been constructed and its constants checked. In order to be able to represent cable circuits as well, an artificial power cable is being designed along the same lines, so that it will contain inductance as well as capacity and resistance and therefore properly transmit a transient wave front.—*F. S. Dellenbaugh, Jr., Massachusetts Institute of Technology.*

Welding, Contact Flash Method of

An electric welding machine embodying a new principle will soon be available. The weld is made almost instantly. The nearby metal is not heated and a weld can be handled immediately after being removed from the welder without burning the hands. At present the contact flash process welds stock of 1-in. diameter on an experimental welder, and it is expected to weld stocks 1¼ in. in diameter or larger when a final model is built.—*H. A. Woofter, Lynn, Mass.*

Welding, Electric Seam

Much development work has been carried on within the last two years. Until recently two sheets of No. 20 gage stock was the maximum limit for flat commercial work, while two sheets of No. 18 gage stock could be seamed by previously scarfing the edges. The limit in length of seam for this work was about 2 ft. Now, however, two ⅛-in. sheets have been welded on an experimental machine, and the length of seam can be practically anything that can be procured in commercial stock. This method can be applied to the manufacture of steel barrels, casks, tanks, culverts, smokestacks, ventilators, conveyor tubes, heating and ventilating pipes, etc.—*H. A. Woofter, Lynn, Mass.*

Apparatus Available

Phase Advancer for Induction Motors

A small experimental phase advancer has been developed suitable for research. It has the appearance of a three-phase commutator motor with no stator winding. After a phase-wound induction motor is brought up to speed in the usual manner, the brushes of the phase advancer are connected to its slip rings. The power factor of the motor may then be kept at approximately 100 per cent over a wide range of load.—*Westinghouse Electric & Manufacturing Company. East Pittsburgh, Pa.* [Such a phase advancer is used to some extent in Europe for power-factor correction of large induction motors, and it is desirable to acquaint the oncoming generation of engineers with its theory and possibilities.—EDITOR.]

Suggestions for Research

Conduits, Underground, Trenches for

In many places in New Orleans submerged cypress stumps are found which have to be cut through or removed in making trenches for cables or pipes. The wood is perfectly preserved and quite hard. Being in a thickly populated district, it is hardly possible to use the familiar methods for removing stumps, applicable say in an open field. It will be of interest to us to have some machine or method developed which would permit cutting through such stumps at a reasonable speed and at moderate expense.—*F. G. Frost, New Orleans Public Service, Inc.*

Fuses, High Voltage, for Potential Transformers

On numerous occasions the fuses on the 13,200-volt side of potential transformers opened in service without apparent cause. A microscopic examination in some cases has shown some corrosive chemical action. Tests on 0.004-in. wire used in some of our fuses have shown that at 13,000 volts the wire is entirely surrounded by corona which may cause this deterioration. A further investigation of this trouble is desired; in the meantime it is recommended that such fuses be renewed at fixed intervals.—*A. F. Bang, Pennsylvania Water & Power Company, Baltimore.*

Monel Metal, Arc Welding of

Attempts to arc-weld monel metal have not been successful in the past, but it seems that better results can be obtained by using a deoxidizing coating and by making the welding rod positive, instead of the work. For some tests in this direction see the *Journal* of the American Welding Society, May, 1922.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Stratton Inaugurated

New Head of Massachusetts Institute of Technology Is Welcomed by Distinguished Men

IN THE presence of a distinguished assemblage of educators, scientists, engineers, publicists and leaders of industry, Dr. Samuel Wesley Stratton was inaugurated as president of the Massachusetts Institute of Technology at Symphony Hall, Boston, on Monday of this week. The dependence of modern civilization upon engineering education and research was the text of the inaugural exercises, led by Frederick P. Fish of Boston. Mr. Fish emphasized the pioneer work of the institute in engineering education and touched upon the value of the broad training given in addition to technical instruction in meeting the intense strain upon modern social and business organization resulting from industrial conditions based upon the most extraordinary development in science that the world has ever seen.

Governor Cox brought the greetings of the state; Major-Gen. George O. Squier, U. S. A., saluted the new president and paid a warm tribute to his work at Washington; Prof. Edward F. Miller voiced the welcome of the institute's instructing staff; President Emeritus Charles W. Eliot of Harvard outlined the pioneering work in education achieved by the institute as a private organization, pointing out that public institutions can never be expected to do the pioneering work of education; Prof. C. E. A. Winslow of Yale spoke on behalf of the alumni and President John C. Merriam of the Carnegie Institution of Washington emphasized the value of training penetrating far beyond superficial technique for the engineer of the future. While there is no limit to the extent to which fundamental research may go, President Merriam said, it is expected that the results shall be used to help in the work of the world.

VALUE OF RESEARCH LABORATORIES

In his inaugural address President Stratton gave a masterly review of the effect of science in the evolution of industry, sketching the progress of engineering in the fields of physics and electricity for the past century and pointing out the increasing demands of industry for highly trained engineers. Touching upon the value of the research laboratory, the speaker said that one single discovery may be worth many times the cost of such a laboratory, while at the same time it is turning out men trained to analyze and solve difficult problems, whether they are found in engineering, in scientific laboratories or in industry — a product of inestimable value.

Plans Laid for City Operation of Milwaukee Utility

The latest developments in the controversy between the city of Milwaukee and the Milwaukee Electric Railway & Light Company over a contract whereby the city is to take over and operate the electric light and power and street-railway systems of that company were unfolded by Fred S. Hunt, chairman of the public utilities acquisition committee which has been investigating the public utilities question for the city nearly five years, in a recent semi-public talk. Plans are now being made for the drawing up of a new contract between the city and the company as to rates and service which will be submitted to the Common Council in about a month. This contract must be approved by the State Railroad Commission and then submitted to a referendum of the voters of the city.

The properties to be covered by the contract, including both electric plant and street-railway lines in Milwaukee and vicinity, have been valued at about $50,000,000, Mr. Hunt said, for the purposes of the proposed agreement. The company is now paying taxes of nearly $1,300,000 a year.

The city cannot buy the electric light and power and street railway properties of the Milwaukee Electric Railway & Light Company because of lack of funds, Mr. Hunt continued. He stated that the committee had been given access to the company's books. Under the service-at-cost plan to be proposed the city and company will virtually enter a partnership. The value of the company's property and the rate of return will be agreed upon. All profits over this will be applied toward the purchase of the plants by the city or used for extensions to belong to the city. The city can also use its credit to raise money for extensions and improvements which will belong to the city and be leased to the company for operation. A considerable part of the control now exercised over the company by the State Railroad Commission will be vested in the city, the commission being called in when differences arise.

The city and company will thus become partners, and surplus profits will be applied, according to the plan as expounded by Mr. Hunt, to bring about gradually city ownership of the utilities.

Franchise Is Refused

Colorado Springs Electors Reject Proposal to Continue Service from Existing Local Company

BY THE decisive vote of 2,948 to 866, the electors of Colorado Springs, Col., on Tuesday refused the twenty-five-year license sought by the Colorado Springs Light, Heat & Power Company. The present franchise of that company expires on Sept. 8, and it cannot be predicted whether the city will offer a counter proposal to the company, grant a franchise to some other utility company or seek some way in which to establish a municipal plant.

The last-named project suffered a setback when the report of Gen. George W. Goethals, who, as already stated in these columns, had been employed by the central-station company to report on the situation, made the result of his survey of the Pike's Peak watershed known, declaring that it does not contain enough water to make it possible to serve Colorado Springs through an all-hydro-electric development and that a steam plant for auxiliary service will continue to be necessary. This finding was awaited with much interest by Colorado Springs and the electrical industry of Colorado in view of an earlier report by G. G. Anderson, an irrigation engineer of Los Angeles, declaring that an ample supply of water was available to meet all requirements. In his report General Goethals declared that the cost of water development would be more than $2,000,000, compared with $597,000, the estimate of city engineers.

Under the terms of the old franchise title to the already existing hydro-generating plant at Manitou passes to the city, the reserve steam plant at Colorado Springs being left in the hands of the central station.

Mississippi Power & Light Company Organized

The Mississippi Power & Light Company has been recently incorporated in Maryland to acquire the property and business of four Mississippi companies—the Delta Light & Traction Company of Greenville, the Jackson Public Service Company of Jackson, the Vicksburg Light & Traction Company of Vicksburg and the Columbus Railway Light & Power Company of Columbus. These companies have been owned and operated by separate interests, most of which were outside the state,

and the properties have never been intensively developed.

The new company will be managed by H. C. Couch and associates, who have operated successfully for the past ten years the Arkansas Light & Power system and are thoroughly familiar with the territory. The engineering firm of Ford, Bacon & Davis has reported that there are unusual opportunities for rapid expansion, both by taking on additional customers in communities now served and by extending lines to adjacent communities.

Power Club Acts on Temperature Ratings

Rescinds Its Two Previous Standards and Approves New "Recommended Practice" for 40-Deg. Rise—Year's Trial Proposed—Timmerman Elected President

THE Electric Power Club at its meeting in Hot Springs, Va., this week took a great stride forward in disposing of the old temperature rating question by abandoning both of the former adopted standards and by adopting as "recommended practice" a 40-deg. rating without overload guarantee. The formal statement of the board of governors on this question is as follows:

"The Electric Power Club has rescinded its two 'Adopted Temperature Rating Standards' on general-purpose motors:

"(1) The 50-deg. motor without overload guarantee, and

"(2) The 40-deg. motor with 25 per cent overload guarantee for two hours; and has approved as 'recommended practice' the following:

"'(a) An open-type general-purpose motor shall be capable of carrying full rated load continuously with a temperature rise not exceeding 40 deg. C.

"'Note.—Such a motor should be so designed as to be capable of carrying sustained overloads (in no event exceeding 50 per cent overload) within a temperature of 90 deg. C. (measured by thermometer).

"'(b) That it is the sense of the Electric Power Club at this time that general commercial practice of the ensuing year will probably lead to the unanimous support of the club to the adoption of a single-rating temperature standard for general-purpose motors without overload reference of any character.

"'(c) That within a year the "recommended practice" referred to in paragraph (a) be submitted to the Electric Power Club for vote as an "adopted standard."'"

By this action the club has solved one of the troublesome commercial engineering problems which have been continuously before the industry in one form or another for seven years.

Sessions of the convention, which was the largest the club has ever had, were held on Monday, Tuesday and Wednesday. President Russell, who closed two years' administration at this meeting, called attention in his address to the constructive work of the various sections and of the club and gave credit for all of this to the men who had devoted so much time to active committee work to bring about agreement on many difficult engineering and commercial questions. He presented actual figures of the number of "man-days" spent, which were remarkable for an organization of the size of the Electric Power Club.

The club authorized a broadening of the scope of the electrical measurement section so that it now includes indicating, integrating and recording meters. Three new concerns were elected to club membership, the Sundh Electric Company, the Wilson Welder & Metal Company and the Sewickley Electric Manufacturing Company.

The club took formal action to become a sustaining member of the American Engineering Standards Committee. Standards for step-up transformers were agreed upon, previous transformer standards having applied principally to step-down transformers. The transformer section also issued at this meeting a published booklet of general instructions for the care and operation of power transformers which is obtainable from member companies. Synchronous motor standards, circuit-breaker definitions and specifications for building equipment-control apparatus were adopted.

TRADE ASSOCIATION OPPORTUNITIES

At the dinner on Tuesday evening the principal address was by F. M. Feiker, who spoke on the opportunities of trade associations to be of greater service to their industries by the gathering of statistics, the support of programs of simplification and similar co-operative efforts which have been pointed out as lawful by the Commerce Department.

A. L. Ashby of the Westinghouse Electric & Manufacturing Company addressed the club on Wednesday on the subject of contracts as related to national distribution, showing points to be watched on account of variation in state laws. R. W. Gardner of the Otis Elevator Company addressed the club on methods of preventing waste in manufacture.

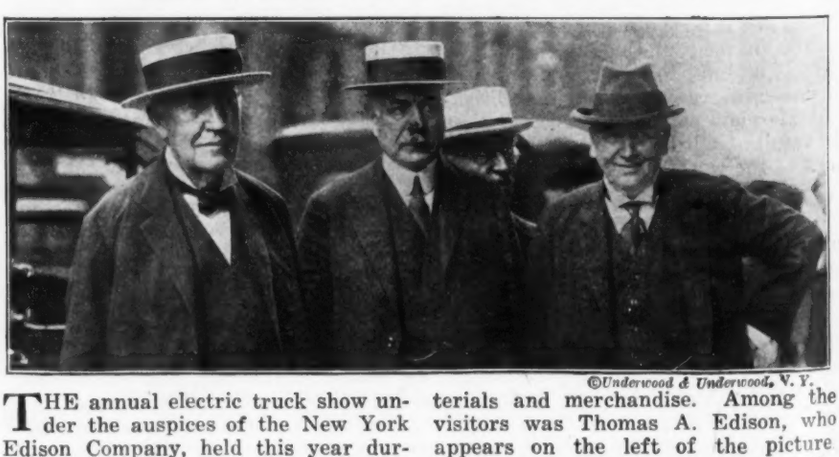
J. M. Barr, F. S. Hunting, J. A. Jeffrey and A. E. Waller were elected governors to fill the places of R. J. Russell, C. H. Roth, T. E. Barnum and C. L. Collens, 2d, whose terms had expired and who under the new rules were not eligible for re-election. At a meeting of the new board of governors the following officers were elected: President, A. H. Timmerman of the Wagner Electric Manufacturing Company; vice-president, James K. Bass of the Kimble Electric Company; secretary, J. M. Barr of the Louis Allis Company; treasurer, H. F. Stratton of the Electric Controller & Manufacturing Company.

Lively Contention Over Pike Rapids, on Mississippi

No decision was made by the Federal Power Commission following a hearing on June 7 in the controversy over the development of Pike Rapids, 12 miles below the town of Little Falls, Minn., on the Mississippi River. The commission directed the Little Falls Water Power Company and the Pike Rapids Power Company to submit financial statements and engineering and legal briefs.

James O. Heyworth, a Chicago engineer, contended that the Pike Rapids company was in a position to put in the development at a cheaper unit cost and with all arrangements made for immediate operations. M. O. Leighton, who represented the Little Falls company, attacked the safety of the works proposed by the Pike Rapids company.

Edison Visits New York's Truck Show



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THE annual electric truck show under the auspices of the New York Edison Company, held this year during the N. E. L. A. convention last week, was well attended and, as usual, attracted much interest from those concerned in city transportation of materials and merchandise. Among the visitors was Thomas A. Edison, who appears on the left of the picture George B. Cortelyou, president of the Consolidated Gas Company, is in the center and Arthur Williams, New York Edison Company, on the right.

Supreme Court Decides Many Points

Prohibition of Extrastate Sale of Gas Unconstitutional—Kansas Industrial Court Deprived of Power—Mennen Verdict Sustained—Other Cases of Import to Utilities

A NUMBER of decisions with a special bearing on the regulation of public utility companies or the organization of trade associations have been made by the United States Supreme Court in the last eight or ten days. Below will be found digests of five such findings. Under "Recent Court Decisions," on page 1435, are digests of two others—one upholding the finding of a lower federal court in Brush Electric Company vs. Galveston, that a suit cannot be brought on the ground of confiscation before rates have been put into effect and where estimates of income are based on the business of former years, and the other, in the government's suit against the American Linseed Oil Company and others, forbidding the exchange of sales information and quotations through an outside agency.

Ban on Gas Export Beyond State Boundaries Illegal

A decision of the highest court in the land which involves a possible application to state laws designed to limit the exportation of electrical energy generated within the state was handed down on Monday of this week in a suit brought by the States of Pennsylvania and Ohio against West Virginia. This suit was instituted to restrain West Virginia from putting into effect a law compelling natural-gas companies supplying gas taken from within the state to serve consumers within its borders in preference to those outside the state.

In delivering the majority opinion Justice Van Devanter said: "Natural gas is a lawful article of commerce, and its transmission from one state to another for sale and consumption in the latter is interstate commerce. A state law, whether of the state where the gas is produced or that where it is to be sold, which by its necessary operation prevents, obstructs or burdens such transmission is a regulation of interstate commerce—a prohibited interference. The West Virginia act is such a law. Its provisions and the conditions which surround its operations are such that it necessarily and directly will compel the diversion to local consumers of a large and increasing part of the gas heretofore and now going to consumers in the complainant states and therefore will work a serious interference with that commerce."

The facts that the pipe-line companies are engaged in a quasi-public business and that gas is a natural product of the state and has become a necessity therein do not, Justice Van Deventer said, afford "power to regulate interstate commerce, which is what the act attempts to do. The power is lodged elsewhere." He concluded:

"On full consideration, we reach the conclusion that the act is unconstitutional; that the apprehensions of the complaining states respecting the injury which will ensue from its enforcement are well founded, and that it obviously will operate most inequitably against those states. In this situation the appropriate decree is one declaring the act invalid and enjoining its enforcement."

Justices Holmes, Brandeis and McReynolds dissented, Justice Holmes holding that there was nothing in the commerce clause "to prevent a state from giving a preference to its inhabitants in the enjoyment of its natural advantages. The statute," he said, "seeks to reach natural gas before it has begun to move in commerce of any kind. It addresses itself to gas hereafter to be collected and states to what uses it first must be applied. The gas is collected under and subject to the law, if valid, and that moment it is not yet a matter of commerce among the states. I think that the products of a state,until they are actually started to a point outside, may be regulated by the state notwithstanding the commerce clause."

Kansas Industrial Court Cannot Fix Wages

The Kansas Court of Industrial Relations received what may prove to be its deathblow when the United States Supreme Court, on June 11, in a unanimous opinion read by Chief Justice Taft, declared that the Industrial Court had no authority to fix wages of employees of the Charles Wolff Packing Company. While the Supreme Court did not directly declare the entire act creating the Industrial Court unconstitutional, the decision greatly limits the activities of the Kansas industrial tribunal and the effect probably will be to nullify the objects for which it was created.

The Kansas act gave the Industrial Court authority to adjust disputes and fix wages and conditions of labor in public utilities and in industries producing food, clothing and fuel. While an employee could not be prevented from quitting his job, concerted action, such as a strike, in the face of a mandate from the court was declared illegal.

In the case at issue the company resisted payment of higher wages and appealed to the United States Supreme Court from a mandamus issued by the Supreme Court of Kansas.

In his decision Chief Justice Taft says: "It [the act creating the Industrial Court] curtails the right of the employer on the one hand and of the employee on the other to contract about his affairs. This is part of the liberty of the individual protected by the guarantee of the due-process clause of the Fourteenth Amendment." No effort was made in the opinion to lay down a working rule by which readily to determine when a business has become "clothed with a public interest."

"It has never been supposed, since the adoption of the Constitution, that the business of the butcher, the baker, the tailor, the wood chopper, the mining operator or the miner was clothed with such a public interest that the price of his product or his wages could be fixed by state regulation," the opinion states.

"To say that a business is clothed with a public interest is not to import that the public may take over its entire management and run it at the expense of the owner. The extent to which regulation may reasonably go varies with different kinds of business. The regulation of rates to avoid monopoly is one thing. The regulation of wages is another. We think the Industrial Court act, in so far as it permits the fixing of wages in plaintiff-in-error's packing house, is in conflict with the Fourteenth Amendment and deprives it of its property and liberty of contract without due process of law."

Mennen Decision Upheld

On Monday of this week the United States Supreme Court handed down a decision declining to review the finding of the Circuit Court of Appeals in the action brought against the Mennen Company by the Federal Trade Commission. In this case, which was noted in the ELECTRICAL WORLD for March 17, page 646, the Circuit Court held that co-operative or mutual associations, although buying in wholesale quantities, are retailers and that, in a case presenting no circumstances of fraud or monopolistic control or conspiracy, a manufacturer is at liberty to adopt any price schedules which he considers fair to the various branches of trade to which he sells. The commission denied that the manufacturer had this liberty and contended that the manufacturer could vary his price schedules only for quantity, actual differences in cost of transportation and various other elements which the commission inferred from the Federal Trade Commission act and the Clayton act.

One Utility Wins, Another Loses in Rate Appeals

Two cases involving questions of the valuation of a public utility for rate-making purposes were decided by the United States Supreme Court on Monday last. In Bluefield Waterworks & Improvement Company vs. Public Service Commission of West Virginia, on appeal from the state courts, the Supreme Court held that the rates fixed for water service in 1920 at Bluefield and designed to give a return of 6 per cent were inadequate and confiscatory. The company had alleged the value of its property to be greatly in excess of that fixed by the commission and complained

that the commission did not allow for increased costs of replacement between 1915 and 1920.

In the case of the Georgia Railway & Power Company and the Atlanta Gas Light Company the Supreme Court affirmed the decree of the lower courts dismissing a suit against the Railroad Commission of Georgia to restrain reduced rates for Atlanta's gas supply. Although Associate Justice McKenna dissented from the majority opinion, holding that replacement value, as fixed in principle by the court in the cases of the Southwestern Telephone Company and the Bluefield Waterworks & Improvement Company, had not been applied in this case, the majority opinion pointed out that in the case before the court the Railroad Commission had carefully considered replacement value and increased costs, although it did not allow all the claims of the company in this regard; hence the case differed from the others cited as precedents.

New York Electrical Board

Activities to Cover Many Phases — Sections to Meet Needs of Investors, Creditors, Bankrupts and Others

DEFINITE plans for promoting the welfare of the entire electrical industry have been made by the recently organized Electrical Board of Trade of New York City, the formation of which was noted last week (page 1375). Charles L. Eidlitz, the board's chairman, informs the ELECTRICAL WORLD that the board's intended activities cover many phases. These include a special section in the board's offices for an advertising pool as an aid to newspaper advertisers, a legislative section to consider state and federal legislation, a patent bureau where inventors may list their inventions for the purpose of selling them to manufacturers, a credit bureau, registration of bankrupts, a section which will collect information as to excess stocks or shortages on the shelves of its members, an exhibition of new apparatus, historical exhibits for the purpose of creating public interest, advice to those contemplating going into an electrical business, and a special section which will attempt to stop sales and purchases of stolen electrical goods.

The organization will be actively controlled by a board of governors consisting of three representatives elected from each branch of the industry, and it is estimated by Mr. Eidlitz that when in full operation the board will number about thirty-six men, who will represent several thousand corporations, firms and individuals. The temporary officers elected were named in these columns last week. A temporary board of governors consisting of twenty-eight men was also elected.

The constitution of the board says in part:

"The objects of the Electrical Board of Trade of New York shall be to promote generally the interests of the electrical industry, to deal with problems concerning or affecting the industry, to represent the industry in public affairs or legislative matters affecting the industry, to be the central organization and headquarters for the entire electrical industry of the city of New York and territory hereinafter mentioned. Its activities shall be directed only along constructive lines within the industry by the encouragement of sound, ethical and progressive business methods. The board shall not, however, in any way deal with prices nor shall it foster combinations or agreements in restraint of trade."

Ford License Executed

He Will Install 18,000 Kva. at High Dam in Hydro Units and About 15,000 Hp. in Steam Plant

A LICENSE extending to Henry Ford the right to utilize the High Dam on the Mississippi River at St. Paul for a period of fifty years has finally been executed by the Federal Power Commission. The license covers the construction of a power house on the existing substructure at the St. Paul end of the dam. The power house will be equipped with four turbo-generators, each with a capacity of 4,500 kva., or 500 kva. in excess of the minimum figure named in the preliminary permit.

Three-foot flashboards will be placed on the dam so that water may be ponded during off-hours and so that the head may be raised in ordinary high water. Mr. Ford will construct a steam auxiliary on the bank adjacent to the hydro-electric power house. The capacity of this auxiliary has not been determined finally, but presumably it will be 15,000 hp., since there is about that much difference between his firm power and his secondary power at the dam. This steam plant will be designed to burn the plant refuse and to furnish steam for heating the factory.

Mr. Ford's representatives presented to the Federal Power Commission a signed contract with the Northern States Power Company whereby the latter agrees to use all of the available power in excess of the needs of the manufacturing plant at a fixed price of 2½ mills per kilowatt-hour.

It is understood that Mr. Ford is planning to manufacture storage batteries for his cars at this plant. The estimated output of the plant will be 6,000 batteries per day. He desires to establish a barge service between St. Louis and St. Paul to bring the raw materials entering into battery construction up the river and return with the manufactured product.

The license was accepted with the reservation that an argument later may be presented by Mr. Ford's representatives for a reduction in the capital sum being paid for the use of the government structure and for a reduction in the rate of interest. In the report of the Chief Engineer it is suggested that $70,000 per annum would be fair reimbursement to the government. The license calls for a rental of $95,440 per annum.

Eber Bill Defeated

Wisconsin House Is 51 to 39 Against a Two-Year Postponement of Electrical Development

THE Eber water-power bill, providing for a cessation of water-power development in Wisconsin by private interests for a period of two years and appropriating $25,000 for a survey of water-power sites by the Railroad Commission, was killed by the Assembly when it came up for final passage in amended form. As reported in the ELECTRICAL WORLD for May 26, page 1230, this bill originally made the period of delay six years. Its defeat even in the amended form is thought to mark the final downfall of an attempt to stifle hydro-electric progress in Wisconsin. The vote was fifty-one to thirty-nine in favor of the indefinite postponement of the measure.

The proposed plans of Henry Ford with respect to water-power projects in Wisconsin figured prominently in the defeat of the measure. Opponents of the bill said it would prevent Ford from going through with his water-power development program in Wisconsin.

Pacific Gas & Electric Doubles Business in Six Years

For the year ended Dec. 31, 1922, the Pacific Gas & Electric Company of San Francisco showed, as indicated in its seventeenth annual report, gross operating revenue of $38,593,562 and sales of electricity totaling 1,098,123,000 kw.-hr., as compared with a gross operating revenue of $19,813,381 and total sales of 587,144,000 kw.-hr. in 1917, thus nearly doubling its receipts and its sales of energy in a six-year period. In the nine years beginning with 1914 gross income increased 128 per cent, sales of electricity 142 per cent, number of consumers 70 per cent, and number of stockholders (because of the momentum from the customer-ownership movement) 772 per cent.

Deducting from the gross revenue for 1922 charges for maintenance, operation, taxes, depreciation and interest, a net income of $6,587,159 was shown. Adding the balance at the beginning of the year ($7,946,366) and deducting dividends and miscellaneous adjustments, there was left a balance in sinking funds and unappropriated of $8,593,388.

In its electrical business the company serves eighty-nine incorporated cities, 142 villages and towns and a suburban area of 35,000 square miles with a population in excess of a million and a half, occupying approximately 278,000 houses, of which less than 2,000 are unwired. The total output of energy during 1922 was 1,608,940,735 kw.-hr., an increase over 1921 of about 120,000,000 kw.-hr. Of this, 69.9 per cent represents the output of the company's twenty-eight hydro-electric plants, 15.6 per cent was produced in its four steam-electric plants, and 14.5 per cent represents power purchased from other concerns.

Colorado River Compact

League of Southwest Listens to Paper Indorsing It as Drawn—Other Big Plans Discussed

AT AN open conference called by the League of the Southwest on June 7, 8 and 9 at Santa Barbara, Cal., to discuss Colorado River problems and Indian affairs, earnest discussion was given to the present status of the Colorado River compact, which has thus far been passed upon favorably by the legislatures of all the states involved except Arizona.

Robert Sibley of San Francisco, who had traveled ten thousand miles to make a detailed study of the situation, reported, saying:

"Virtual unanimity prevails among the leaders in the seven states involved that, owing to differences in seasons, crops, soil and physical conditions of climate, it is wise to separate the Colorado River drainage basin into two areas, the upper basin and the lower basin, as defined in the proposed Santa Fé treaty now under consideration. The waters of the Colorado River basin under wise adjudication are ample to bring under cultivation all irrigable lands of reasonable approach from the main waters of the river. The Colorado River basin, involving as it does interstate and international problems of floods, irrigation, power and possible navigation, is a matter requiring the closest co-operation of the seven states involved and the federal government. The raising of funds for the complete development of the river, involving as it will a sum probably exceeding a billion dollars, requires the most thorough co-operation of public and private finance. Hence it would seem that the proposed Santa Fé treaty should be adopted in its present form.

PERMANENT COMMISSION FAVORED

"Immediately thereafter the seven states and the federal government should unite in bringing to life a permanent Colorado River commission, composed of men of brilliant attainment and constructive ideals in problems similar to those to be met with in Colorado River development — men thoroughly representative of the seven states involved and of the federal government. This commission should have full and complete authority to supervise the distribution of the waters and building of dams in the canyon district and the disposition of power franchises to private and business enterprises that may desire them. The continual aim of the commission should be so to encourage all involved in the Colorado River development that broad policies of use for this great public resource may be executed at once and the wealth of water and power it contains be brought to Western homes, farms and industries by the fullest co-operation of federal, state, city and private enterprises."

At the conference two other papers of interest to the electrical industry were presented—one by W. G. Clark, a consulting engineer of New York City, who had prepared a detailed study for power development at Boulder Canyon which would require a dam a thousand feet in height; the other by George H. Maxwell of Phoenix, Ariz., executive director of the National Reclamation Association, who presented a preliminary study of a high-line canal to serve Arizona and southern California, involving two dams 700 ft. in height, the development of a million horsepower and the bringing of the Colorado River power not only to the Imperial Valley of California but also to the Los Angeles, Santa Barbara and San Diego districts.

Two More Generators Ordered for Holtwood

For supplying power to two new customers, one of which is the Edison Light & Power Company of York, Pa., and the other the Chester Valley Electric Company of Coatesville, Pa., the Pennsylvania Water & Power Company has ordered from the Westinghouse Electric & Manufacturing Company two 15,000-kva., 80 per cent power factor, three-phase, 13,200-volt, 60-cycle, 94.7-r.p.m. waterwheel generators for installation in its Holtwood station. The current will be stepped up at Holtwood to 73,000 volts and transmitted by double-circuit tower lines to both of these customers. The lines will be designed and insulated for an ultimate voltage of 110,000. The construction work at Holtwood will be done by Day & Zimmermann, of Philadelphia, who operate the customer companies at York and Coatesville referred to.

El Dorado Hydro Plant Will Be Finished This Year

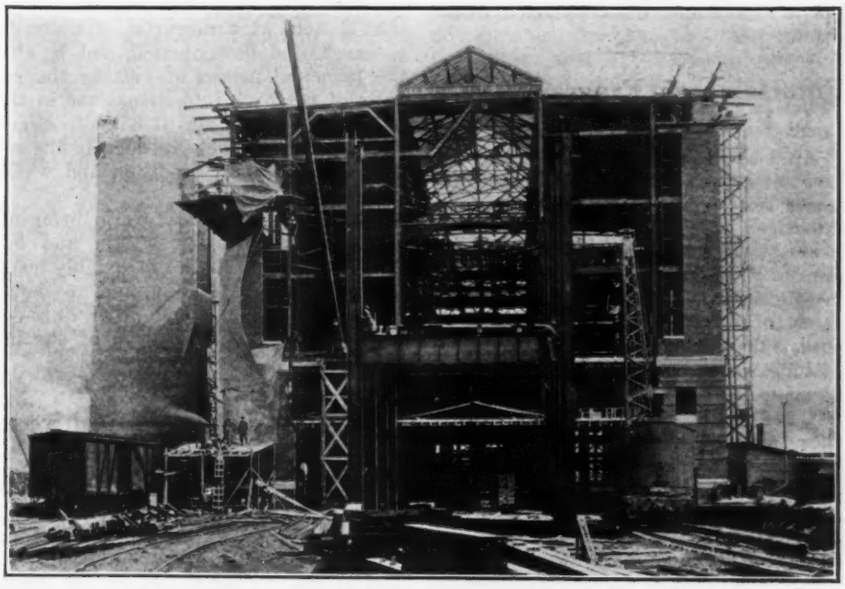
Construction work on the development of the El Dorado hydro-electric project of the Western States Gas & Electric Company is proceeding so well that completion is by December of this year virtually assured, according to F. C. Shenehon, vice-president and general manager of construction and engineering, Byllesby Engineering & Management Corporation, who recently completed an inspection tour of the work in progress on the South Fork of the American River, not far from Placerville, Cal.

"We are busy on all work below the snow line," said Mr. Shenehon. "Construction of the power house is well under way, and work on the flumes, penstock and forebay dam is progressing rapidly. Upward of a thousand men are now employed. By the middle of June it will be possible to resume work in earnest on the construction of the storage dam at the Twin Lakes reservoir site.

"The new station will develop a total of 27,000 electrical horsepower, and available power rights will permit its enlargement to a capacity of 100,000 horsepower as the need arises. The present generating equipment will consist of two units of equal size, driven by impulse wheels operating under a head of 1,750 ft."

The Western States Gas & Electric Company serves a total population of more than 107,000, the principal cities in its territory being Stockton, Eureka and Richmond. About thirty smaller places are supplied.

Pine Grove Plant Rapidly Nearing Completion



THE first 50,000-kw. section of the East Penn Electric Company's new plant at Pine Grove, Pa., is rapidly nearing completion, considerable progress having been made on the building and the stack since the above photograph was taken. This power house, which was designed and is being erected by the J. G. White Engineering Corporation, is to have an ultimate rating of 300,000 kw. It is a mouth-of-mine plant, being built on Swatara Creek, within four or five miles of anthracite coal fields, permitting the use of "fines" or powdered fuel under the boilers of the station.

Pacific Coast Men to Discuss High-Rated Apparatus

The annual convention of the Pacific Coast Electrical Association, which is affiliated with the N. E. L. A., will be formally opened Tuesday noon, June 19, when the delegates will be the guests of the San Francisco Electrical Development League at a luncheon. Preceding the luncheon there will be a parade of electrical vehicles now in use in San Francisco under the auspices of the Electric Transportation Club. The convention will be held at the Fairmont Hotel. The program for the technical sessions is as follows:

TUESDAY, JUNE 19

Afternoon.—Report of apparatus committee; "Inductive Regulators Versus Synchronous Regulators for Distribution Circuits." by J. E. Woodbridge; "220,000-Kv. Apparatus," by H. Michener; report of prime movers committee; report of power-factor committee; "Kva. Demand Meters," by O. A. Knopp.

WEDNESDAY, JUNE 20

Afternoon.—Report of hydraulic power committee; "Water Hammer," by R. J. C. Wood; "Friction Tests on Penstocks," by R. A. Monroe; report of meter committee; report of underground committee; "Underground System of Southern California Edison Company," by N. B. Hinson; "35,000-Volt Cable Installation in Los Angeles," by M. O. Bolser.

THURSDAY, JUNE 21

Morning.—Report of safety rules committee; report of overhead-systems committee; "Operation at 220,000 Volts," by H. A. Barre; paper by W. J. Canada (subject not announced); report of inductive-co-ordination committee.

The Commercial Section will run parallel sessions with the Technical Section. The program for these has not been announced. On Thursday afternoon there will be a trip of inspection to the plant of the Pacific Coast Steel Company in South San Francisco. A trip to Mount Tamalpais on Saturday morning will conclude the convention.

Entertainment Program of A. I. E. E. Swampscott Meeting

An elaborate program of entertainment and inspection trips has been prepared for the annual convention of the American Institute of Electrical Engineers, to be held at the New Ocean House, Swampscott, Mass., in the week beginning June 25. Besides sightseeing trips to Boston and to Lexington, Concord, Salem and Marblehead, all rich in historic interest, trips of inspection will be made each day to places of engineering and manufacturing note. Among these will be the River (Lynn) and West Lynn works of the General Electric Company, the L Street station, Beacon Street substation and service building of the Boston Edison company, Creighton's shoe factory at Lynn, the Naumkeag Mills at Salem, the Simplex Wire & Cable Company at Boston and the Arlington Mills at Lawrence. Arrangements for visits to Harvard University and the Massachusetts Institute of Technology have, of course, been made, and there will be ample provision for golf, tennis, bridge, dancing and concerts.

The technical program as printed in the ELECTRICAL WORLD for May 19, page 1165, has been confirmed without material change. It should have been stated that the paper on the new Weymouth station to be given on Wednesday morning is by I. E. Moultrop and J. Pope.

Dr. Agnew Pleads for Greater Standardization

"The Industrial Significance of Standardization" was the subject of an address made recently by Dr. P. G. Agnew of the American Engineering Standards Committee at a luncheon of the Metric Association in New York. Dr. Agnew said:

"Standardization tends to stabilize production and employment, since it makes it safe for the manufacturer to accumulate stock during periods of slack orders, which he cannot safely do with an unstandardized product. Moreover, by simplifying the carrying of stocks it makes deliveries quicker and prices lower. It reduces selling costs, a fact which is generally overlooked.

"Unit costs to the public, too, are lowered in that mass production is possible, as has been so strikingly shown in the unification of incandescent lamps and automobiles. Standardization is increasingly important for the maintenance and development of foreign trade. There is strategy in nationally recognized 'American' specifications. And by concentration on essentials, and the consequent suppression of confusing elements intended merely for sales effect, it helps to base competition squarely upon efficiency in production and distribution and upon intrinsic merit of product.

"Another benefit of standardization is that it acts as a powerful stimulus to research and development and is also the principal means of getting the results of research into actual use in the industries. Moreover, it helps to eliminate practices which are merely the result of accident or tradition and which impede development.

"Finally, the joint effort in bringing about standardization within and between industries almost invariably leads to better understanding and to beneficial co-operation along other lines—a step toward the integration of our industries."

Electrical Leaders to Address Canadian Association

Delegates from all parts of Canada and many from the United States will gather in Montreal on Thursday, June 21, for the thirty-third annual convention of the Canadian Electrical Association, which will continue until Saturday. Headquarters will be at the Mount Royal Hotel. Dr. M. Luckiesh of the Nela Research Laboratories, Cleveland, will give an illustrated lecture on the lighting of the home, and S. G. Hibben of the Westinghouse company will give a talk and demonstration on industrial lighting. President-elect Walter H. Johnson of the N. E. L. A. and H. M. Edwards, auditor of the New York Edison Company, are also expected to address the convention.

There will be two lunches, a dinner, a dance and an "electrical veterans' night." At Thursday's luncheon H. T. Davies, president of the association, will preside, and the speakers will be Jacques Bureau, M.P., and Mr. Johnson. At Friday's luncheon A. Monro Grier, president of the Canadian Niagara Power Company, will preside, and the speaker will be L. A. Hawkins, research laboratories, General Electric Company, Schenectady, who will take the place of Dr. C. P. Steinmetz. J. F. Gilchrist, Chicago, vice-president Commonwealth Edison Company, will be the chief speaker at the dinner on Thursday night. He will talk on the merchandising end of the electrical industry. A dance will follow the dinner. Friday night will be "electrical veterans' night." The usual full committee reports will be presented.

Iowa Men Prepare Four-Day Program

Meeting at Mason City on June 26-29, the Iowa Section, N. E. L. A., will give the following program:

TUESDAY, JUNE 26

Morning.—President's report, C. N. Chubb; secretary-treasurer's report, M. G. Linn; Public Relations Section, F. J. Hanlon; Technical Section, C. A. Sears; Commercial Section, S. C. Dows; Accounting Section, H. Bellamy; membership committee, R. H. Fowler; rate committee, M. G. Linn.

Afternoon.—Inductive interference committee, Austin Burt, discussion by A. B. Campbell, J. M. Drabelle, C. G. Johnston and H. F. Boehner; rural-lines committee, A. W. Jones, discussion by V. L. Hein and E. L. Fischer; résumé of activities of national rural-lines committee, Arthur Huntington; "Recent Developments Regarding Rural-Lines Liability Insurance," W. S. Ferguson, discussion by W. A. Woodward; committee on taxation of transmission lines, R. H. Fowler.

WEDNESDAY, JUNE 27

Morning.—Address, Frank Hulswit; meter committee, S. M. Cox; "The Meter Instrument Calibration Laboratory at Iowa State College," F. D. Paine; "Sales and Service of Electric Ranges," H. D. Mitchell and V. O. Stafford; "Merchandising," H. L. Green, Waterloo.

Afternoon.—Automobile trip.

THURSDAY, JUNE 28

Morning.—Legislative committee, F. J. Hanlon; Iowa Committee on Public Utility Information, F. J. Hanlon and Joe Carmichael; address by a member of the Iowa Board of Railroad Commissioners; "Recent Decisions Affecting Fair Value, Depreciation and Rate of Return," John A. Reed; "Observations Regarding Increased Taxation of Public Utility Property," John A. Reed; "Model Power-Plant Design," C. L. Shoemaker; discussion by John M. Drabelle, O. W. Harrod, F. A. Beatty, Austin Burt and F. C. Chambers.

Afternoon.—Iowa Electric Railway Association meeting.

Evening.—Banquet.

FRIDAY, JUNE 29

Morning.—"Installation, Operation and Maintenance of Electric Distribution Transformers," C. R. Stahl, discussion by Charles Clark; "Public Utility Accounting," C. J. Anderson; "Customers' Accounts and Collections," George F. Myers and F. J. Larsh; election of officers.

There will be the usual entertainment features, dances and provisions for lake bathing.

Consumers' Power Reports Prosperous Year

The net income of the Consumers' Power Company of Jackson, Mich. for 1922, after the payment of all charges, depreciation, interest on bonds and preferred dividends, was $3,307,388, or $21.06 a share on the $16,175,900 outstanding common stock of the company. This compares with a net income in 1921 of $2,494,044.

Business conditions, the annual report says, were much more favorable than in the previous year and brought greatly increased service demands upon the company. Electric sales increased 31,741,061 kw.-hr., or 17.57 per cent over 1921. Total electric sales for 1922 were 346,149,671 kw.-hr. to 149,124 customers. The company expended $3,784,445 for extensions, additions and improvements in 1922 and now has plans under way for the expenditure of another $10,000,000 during 1923 for improvements.

Items on the income report, comparing with those of 1921, follow:

	1922	1921
Gross earnings	$15,067,116	$14,073,292
Operating expense..	8,302,989	8,373,210
Balance	3,307,388	2,494,044

Brief News Notes

Work on Boulder Lake Plant Started.—Work on the twelve-million-dollar power plant to be erected by the Cities Service Company at Boulder Lake, Col., where a great artificial reservoir is to be made, was begun on June 1.

Western New York Companies to Merge.—Stockholders of the Genesee Light & Power Company, the Western New York Public Utilities Company and the Le Roy Hydraulic Gas & Electric Company have voted to merge, and the combined company will be known as the Western New York Public Utilities Company, Inc. The general offices will be in Batavia.

Waukesha Company Absorbed.—A long-talked-of transfer of the Waukesha Gas & Electric Company to the Wisconsin Gas & Electric Company, Racine, of which the Milwaukee Electric Railway & Light Company is also a subsidiary, is now completed. The first effects of the transfer will be a reduction of rates July 1 or earlier. There will be no change in the management.

Virtually All Utah Coal Mines Electrified.—A contract has been signed between the Utah Power & Light Company and the Utah Fuel Company whereby the former will furnish electric power to the principal mines of the fuel company in Carbon County, Utah. The signing of this contract marks the last step in the electrification by purchased hydro-electric power of virtually all the coal mines in Utah. The Utah Fuel Company formerly used its own steam-generated electric power.

Sioux City to Have Electrical Show.—An electrical exposition will be staged in Sioux City, Iowa, in the fall under the auspices of the Sioux City Electrical Club. Plans are being made to make it one of the best electrical shows ever held in the Middle West, according to C. C. Murphy, president of the club.

Teaching Resuscitation Method to Police and Firemen.—The illustration shows a practical demonstration given to city employees by Levi Bryant of the Dayton Power & Light Company of the prone-pressure method of resuscitation from electric shock, which is also

applied to those apparently asphyxiated or drowned. By arrangement with the Safety Director of Dayton Mr. Bryant, who is an expert in the use of this method, has conducted classes for the purpose of instructing policemen and firemen in its use.

Duncan Riffle Plant Almost Complete.—The eight-million-dollar hydro-electric power plant of the Alabama Power Company at Duncan Riffle, on the Coosa River, will be running at full capacity within sixty days, according to information given out. Two 30,000-hp. units are now going, a third one will be operating within thirty days, and at the end of two months the fourth and last one will start. Even with this additional 120,000 hp. the company will not be able to supply the demand for power.

Pit River No. 3 Construction Starts.—The Mount Shasta Power Corporation, the construction division of the Pacific Gas & Electric Company, has been authorized by the Railroad Commission of California to spend $12,312,600 on power development on the Pit River, to be known as Pit River No. 3. Construction work is already under way. The new plant involves the digging of a 19-ft. pressure tunnel 22,700 ft. long with a capacity of 3,000 sec.-ft. Three penstocks will deliver the water to the power house under a head of 313 ft., developing 108,000 hp.

Louisville Waterside Plant Near Completion.—The steel-skeleton framework of the addition to the Waterside station of the Louisville Gas & Electric Company is now so near completion that the 20,000-kw. turbine is expected to be placed in operation before fall. The total capacity of the plant will then be 67,800 kw. This new extension will include two boilers and allow room for a future turbine. The present rate of growth for the Louisville territory may be gaged from the 8,060 kw. in new power contracts secured during the first four months of this year as compared with 3,730 kw. during the same period in 1922.

Southern Sierras Orders Largest Turbine of Type.—The Southern Sierras Power Company has awarded a contract to the Pelton Water Wheel Company for furnishing a 14,000-hp. single-runner, single-nozzle impulse turbine. This unit will be installed at the power company's Leevening Creek plant No. 1 and will operate under an effective head ranging from 1,531 ft. to 1,622 ft. This, it is announced, will be the largest capacity single-runner impulse turbine in the United States.

Marshall, Tex., Has New Central Station.—The new central power station of the Marshall (Tex.) Electric Company was formally opened recently. The station was built to supply electrical energy for lighting and power purposes to Longview, Jefferson, Hallsville, Kilgore and Woodlawn. The plant and the distribution systems are owned by the American Public Service Company, an Insull property. The formal opening of the plant took the form of a community gathering to inspect the plant and see it in operation. The American Public Service Company has an investment of more than $2,000,000 in east Texas utilities.

Alabama Power's Opelika Line.—The Alabama Power Company is preparing to build a high-tension transmission line from the Coosa River power developments to Opelika at an approximate cost of more than $1,000,000, according to a recent announcement by Thomas W. Martin, president of the company. A primary substation similar to the largest one now in operation by the company and capable of great expansion will be built at Aubrey, on the outskirts of Opelika. At this station the power will be stepped down and transmitted over 44,000-volt lines from Opelika to Lafayette, Roanoke, Auburn, Notasulga Tuskegee, Waverly, Dadeville, Camp Hill and Alexander City.

Philadelphia Electric Schools Merge.—Announcement is made by Provost Penniman of the merger of the Moore School of Electrical Engineering—provided for in the will of Alfred F. Moore—and the School of Electrical Engineering at the University of Pennsylvania. The new school will be known as the Moore School of Electrical Engineering and will have the income from a fund of $1,500,000 left by Mr. Moore, in addition to the funds hitherto at the disposal of the university's electrical engineering department. It probably will be ready for operation next fall. Provost Penniman says that ample space and equipment for the new school are available in the Engineering Building of the university.

Citizen-Aided Development Near Lebanon, Mo., Under Way.—A 2,400-hp hydro-electric development of the Missouri Water Power Company on the Niangua River near Lebanon, Mo., is progressing rapidly, and as the capital for this development has to a great ex

tent been supplied by citizens of Lebanon, that city is much interested in the project. A dam is being built across the Niangua and a tunnel has been drilled through the rock to the level of the lower channel. The power house will be at the dam. The electric plant at Lebanon has already contracted for energy from this plant and poles have been erected between the dam and the city, a distance of 25 miles. An important result of this development will be the creation of a large lake in one of the best fishing districts in Missouri.

Norway Plant in Operation.—The first unit, rated at 2,300 kva., of the new hydro-electric plant of the Indiana Hydro-Electric Power Company at Norway was placed in operation the last of May. Within a short while three other units, also rated at 2,300 kva., will be placed upon the line. This company is a subsidiary of the Middle West Utilities Company and is operated as a unit of the Interstate Public Service Company of Indiana. Transmission lines will tie this plant in with the lines of the Indiana Service Corporation of Lafayette and the Interstate lines supplying power and light for the district surrounding Monticello. An additional transmission line has also been built from Norway to connect with the Central Illinois Public Service Company's lines at a point near the Indiana-Illinois border in the vicinity of Kentland.

Municipal Plant Opposed in Logon, Utah.—The Chamber of Commerce of Logan, Utah, in a special report recommends that the city abandon plans to build a new power plant and suggests instead that power be purchased wholesale from the Utah Power & Light Company under an existing contract which has several years to run. The report shows that $5,000 can be saved annually by purchasing power from the central station. A consulting engineer employed by the city to report on the advisability of erecting a new municipal hydro-electric plant estimates that the cost of the development would be approximately $266,000. The present municipal plant is supplying about 40 per cent of the city's requirements. One-half of the power retailed by the city is purchased from the Utah Power & Light Company at a very low rate under a long-term contract.

Removable Dam Proposed for Snake River.—A license propably will be granted by the Federal Power Commission to the Burbank (Wash.) Irrigation District to place a removable dam in Snake River during the low-water season. The district recently has constructed a power house, but the water supply during the period of minimum flow is insufficient to permit of its operation. The district is not in a position to finance a permanent dam at this time and represents that it is essential to irrigation that the needed diversion be permitted. The chief of engineers in his report expresses doubt as to the feasibility of putting in and taking out each year such a structure as is proposed. He sees no objection, however, to the plan provided the district puts up a bond to guarantee the removal of the obstruction when required. It is probable that the license will be limited to four or five years so as to give the district an opportunity to establish itself financially, at which time a permanent structure can be substituted.

Foshay Buys Tri-State Utilities.—Purchase of the control of the Tri-State Utilities Company by the W. B. Foshay Company of Minneapolis has been announced by Mr. Foshay. The general offices of the company, which operates electric light plants in Iowa, South Dakota and Nebraska, are to be moved to Minneapolis. The company is one which was started by Mr. Foshay in 1917 at Dallas and Winner, S. D. Illness forced him to sell two years later, and the present purchase is the realization of the plans delayed in 1917, he says. This company has total assets aggregating $1,102,607, has two water-power and four steam and Diesel plants and 250 miles of transmission lines. It serves a population of 26,000 persons. A transmission line to connect Nebraska and South Dakota cities with those of the Minnesota electrical distributing company in the southeastern part of the state will be built. The combined companies serve eighty-four cities and have more than 1,100 miles of transmission lines. The total value is estimated at $1,942,000.

Associations and Societies

San Francisco Section, A. I. E. E.—The annual meeting of the San Francisco Section, A. I. E. E., was held May 25. J. H. Anderton, consulting engineer of San Francisco, spoke on "Some Hydro-Electric Developments of Japan" and showed four reels of motion pictures.

Utah Engineers Elect Officers.—At the annual banquet of the Utah Society of Engineers on May 26 the following officers were declared elected: President, Hugh C. Lewis; vice-president, Ernest Gayford; secretary, J. A. Hale; treasurer, R. K. Brown; member of the executive committee, L. D. Anderson. The society has a membership of two hundred.

Newark Has I. E. S. Chapter.—A chapter of the Illuminating Engineering Society has been formed at Newark, N. J., of which William T. Blackwell is chairman and H. C. Calahan is secretary. A meeting in conjunction with the Newark Master Electricians' Association was held on Monday of this week, when S. G. Hibben spoke on "Practical Electric Lighting."

Electrical Manufacturers' Agents' Association.—At a meeting held in New York on June 5 the Electrical Manufacturers' Agents' Association was brought into being. The officers elected were: President, W. S. Brown of the W. S. Brown Company; treasurer, C. W. Boynton of the Electric Products Company; secretary, E. S. White of the Corey Company. The three officers were designated as representatives to the board of governors of the Electrical Board of Trade.

Utah Section, A. I. E. E.—At the last meeting of this section for the season, held on May 31 in the Terminal substation of the Utah Power & Light Company, a resolution was passed favoring a proposed extension of the activities of the Engineering Council of Utah by employing a secretary who will devote his entire time to engineering society affairs. These section officers were elected: Chairman, C. R. Higson; secretary-treasurer, Hiram W. Clark.

Empire State Gas and Electric Association.—A meeting of the Commercial Section of this association will be held at Briarcliff Lodge, Briarcliff Manor, N. Y., on June 28 and 29. On the first day purchasing and storeroom matters, the merchandising of service, of appliances and of street lighting, street-lighting development, advertising appliances, advertising service, advertising good will, and public relations will be discussed. On the second day the topics will be "Investigation of Service Inquiries and Routine," "Rural Service," "Industrial Engineering," commercial, factory and domestic; "Refrigeration," "Commercial Department Accounting" and "Service of the Utility Company from the Viewpoint of an Outsider."

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

North Central Division, N. E. L. A.—Minneapolis, June 20-22. H. E. Young, Minneapolis General Electric Company.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association — Montreal, June 21-23. Louis Kon, 65 McGill College Ave., Montreal.

Southern Appalachian Water Power Conference — Asheville, N. C., June 25-27. J. A. Switzer, Knoxville, Tenn.

American Institute of Electrical Engineers —Annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Atlantic City, June 25-29.

Iowa Section, N. E. L. A. — Mason City, June 26-29. M. A. Linn, Des Moines Electric Co., Des Moines.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29. Frederic Nicholas, 30 East 42d St., New York.

National Council Lighting Fixture Manufacturers—Buffalo, June 26-28. C. H. Hofrichter, 233 Gordon Square Bldg., Cleveland.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13. D. L. Gaskill, Greenville.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Michigan Electric Light Association—Grand Rapids, Sept. 11-13. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Iron and Steel Electrical Engineers — Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

Recent Court Decisions

Suit Brought on Ground of Confiscation Where Rates Have Not Been Put Into Effect Is Premature.—The United States Supreme Court on June 4 affirmed the action of the District Court in dismissing a suit brought by the Brush Electric Company against the city of Galveston, Tex., to enjoin a reduction in rates. The company supplies light and power in Galveston under a franchise granting the city authorities power to regulate rates. In 1918 an ordinance was adopted increasing rates. In 1919 another ordinance sought to reduce the rates made effective in 1918. The company sued to test both ordinances, alleging that the 1919 rates were so low as to be confiscatory. A special master made a report on valuation to which both sides excepted. The District Court changed the master's report and then entered an order dismissing the suit on the ground that, inasmuch as the 1919 ordinance rates had not been put into effect and estimates of probable income under its rates were based on business volume several years before, it could not be determined whether the rates were confiscatory or not.

Allowance of Element of Going Value Proper, Though Business Had Been Operating at a Loss.—Reversing an order of the lower court which set aside rates fixed by the Missouri Public Service Commission for steam heat supplied by the Kansas City Light & Power Company (State ex rel. Case vs. Commission), the Supreme Court of Missouri held that because the business of the company in furnishing steam heat had been conducted at a loss for three successive years owing to the great increase in the cost of fuel, labor and material during those years an allowance by the Public Service Commission of "going-value" or intangible value of the plant as a going concern was not therefore unlawful, where there was no evidence that the business when on a normal basis had not been a feasible or practicable business and no showing that the demand for the commodity furnished had in any manner decreased. Allocating and apportioning the valuation and operating expenses of the plant on the basis of 85 per cent chargeable to steam heat and 15 per cent to electricity was proper under evidence showing the primary use of the plant concerned to be for the furnishing of heat, and that to use the plant for producing electricity only would make the expense of the electrical energy prohibitive and the operation of the plant unprofitable. The court further held that a finding of the commission as to the value of the property of the company was not void for failure to itemize or separately state the "going-concern" or "intangible" value of the plant, where no evidence was introduced to show such value separately from the physical value of the plant. (249 S. W. 955.)*

Exchange of Sales Information and Quotations Through Outside Agency Forbidden.—Manufacturers in the same industry cannot exchange information as to sales and prices virtually as a unit controlling the business of the industry without coming into conflict with the Sherman law, even though the information be cleared and distributed by an independent agency, the United States Supreme Court held in its decision reversing the action of the District Court for Northern Illinois in holding for the defendants in the government's suit against the American Linseed Oil Company and eleven other manufacturers and the Armstrong Bureau of Related Industries. The opinion directed the District Court to grant the government the injunction it had sought. The twelve linseed-oil manufacturers were subscribers to the Armstrong bureau. They are alleged to have controlled a large part of the business of their industry. They agreed to turn over to the bureau full reports of sales, quotations, offerings and other information. They were to receive through the bureau data on the market, trade and manufacturing conditions in the industry and on economies in manufacture and sale, information regarding credit of buyers, uniform cost accounting systems, fair freight rates, standardization of products and other matters.

California Commission Sustained in Southern California Edison Case.—The California Supreme Court has sustained the action of the Railroad Commission in ordering a reduction of 10 per cent in the rates of the Southern California Edison Company and in refusing to open the proceedings involving the 10 per cent rate reduction to include a general rate investigation. Sidney E. Saunby, C. A. Melcher and the California Farm Bureau Federation had contended that the order of the commission was unlawful in so far as it operated to continue in effect the former order of the commission as to the amount of taxes to be estimated and allowed the corporation as operating expenses and also as to the allowance of any portion of the sum paid by the corporation as United States income taxes as operating expenses. The commission in its order denying a petition for rehearing had set forth its reason as follows: "Case No. 1710 was in the nature of an emergency proceeding and limited in its scope in order that certain reductions in rates might be made effective immediately. This course was agreed to in general by attorneys in the proceeding and was taken with the specific understanding that the commission would, on its own motion, institute a further proceeding to investigate fully the rates, rules and practices of the Southern California Edison Company. Pursuant thereto the commission has instituted a proceeding into the entire question of the reasonableness of the rates, rules and practices of the Southern California Edison Company (Case 1759), and in view of this fact and the limitations of the scope of Case No. 1710 it does not appear that there is any justification for granting a rehearing on the grounds set forth in the petition herein."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Companies Must Stand by Representations of Authorized Employee.—The Wisconsin Railroad Commission has ordered the Burkhardt Milling & Electric Power Company to discontinue a standby or demand charge made to a creamery association during months of the year when the association's motor was out of service. The commission found that the power company's interpretation of the rates was correct, but that it had been wrongly interpreted to the customer by the employee who solicited the business and that the company must stand by the oral statements of its authorized representative despite the fact that to do so involved a slight degree of discrimination.

Exchange Value Different from Condemnation Value.—In the case of the Pacific Gas & Electric Company, which desired to exchange certain properties with an affiliated company to eliminate duplication and competition, the California Railroad Commission approved a value which represented the historical cost of the property less the reasonable depreciation accrued in the case of each company in the normal operation of its business. The facts that both parties were public utilities whose rates were subject to regulation and that the existing duplication would result in the taking down of certain lines, thus reducing them to a salvage value, were those on which the commission based its ruling.

Rates for Electric Cooking.—In substituting for a minimum charge plus an energy charge a monthly service charge plus an energy charge in the electric cooking rates of the Sauk City municipal plant, the Wisconsin Railroad Commission said: "While it is desirable to offer as low a rate as is consistent with the cost of service for furnishing energy for cooking purposes, it must be borne in mind that, especially in small communities, the fixed charges involved in furnishing this service are quite material. Oftentimes special transformers have to be provided for cooking installations; heavier secondaries are required, together with special metering equipment. These cause a substantial burden of fixed costs in connection with this service which may properly be met by a service charge corresponding to the very generally accepted practice with reference to power rates."

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

S. B. Irelan Leaves Montgomery

S. B. Irelan, vice-president and general manager of the Montgomery (Ala.) Light & Water Power Company, has been appointed vice-president and manager of the St. Joseph (Mo.) Railway, Light, Heat & Power Company, succeeding B. C. Adams, who, as was announced in the June 9 issue of the ELECTRICAL WORLD, goes to Toledo. Mr. Irelan has been in Montgomery since 1919, when he was transferred from Sedalia, Mo., where he was vice-president and general manager of the City Light & Water Company. He became identified with the Doherty interests following his graduation from Purdue University, when he enrolled in the engineering school of Mr. Doherty at Denver. In 1910 he was made secretary and treasurer of the Fremont (Neb.) Gas & Electric Light Company, a Doherty property, and two years later was transferred to the engineering department of Henry L. Doherty & Company in New York. Subsequently he was vice-president and general manager of the Bartlesville (Okla.) Gas & Electric Light Company, going from there to Sedalia.

J. H. Shearer, general superintendent of the Penn Central Light & Power Company, has received the title of vice-president.

C. O. Culver, general superintendent of the Eastern Shore Gas & Electric Company, with offices at Salisbury, Md., has been made general manager of the company.

Geoffrey T. Cooper, who was formerly with the Narragansett Electric Lighting Company of Providence, R. I., is now associated with Stone & Webster, Inc., Boston, as electrical designer.

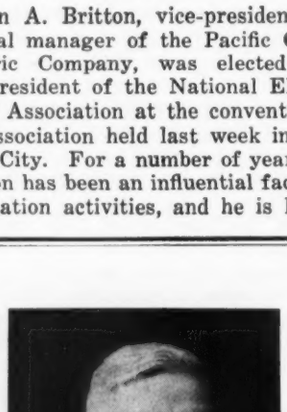
L. E. Perry, formerly superintendent of the East Aurora (N. Y.) Electric Light Company, is now associated as engineer with the Charles M. Kelso Company, Inc., contracting engineers, at Utica, N. Y.

Harold F. Rice, formerly associated with the General Electric Company, Schenectady, N. Y., is now in the electrical engineering department of the Denver (Col.) Gas & Electric Light Company.

C. R. Higson, assistant to the general superintendent of the Utah Power & Light Company at Salt Lake City, has been elected chairman of the Utah Section of the American Institute of Electrical Engineers. Mr. Higson has been identified with public utilities in Utah since 1911, when he joined the Utah Light & Railway Company at Salt Lake City. The following year, when the Utah Power & Light Company was organized, he entered its engineering and operating department. He is a native of Salt Lake City and a graduate of the University of Wisconsin.

Britton Elected First Vice-President of N. E. L. A.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, was elected first vice-president of the National Electric Light Association at the convention of the association held last week in New York City. For a number of years Mr. Britton has been an influential factor in association activities, and he is known throughout the country for his contributions as executive-engineer to the building of Pacific Coast utilities. Although born in the East in 1855, he has been associated with California since his thirteenth year. In 1874 he became associated with the Oakland (Cal.) Gas Light Company, steadily advancing to the position of president, and in 1903, when the company sold out to the California Gas & Electric Corporation, he was retained as chief executive of the new organization. It was in 1907 that Mr. Britton was made vice-president and general manager of the Pacific Gas & Electric Company, into which the California Gas & Electric Corporation had been merged. In this capacity he has had charge of all construction work and been responsible for the operating and financial policies of the company, and the success with which he has shouldered these herculean tasks has made him an outstanding figure among the leaders of the industry. Mr. Britton is a regent of the University of California, president of the Bohemian Club of California and a member of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers.



J. A. BRITTON

David B. Rushmore, consulting engineer of the General Electric Company, has received the degree of D.S. from his alma mater, Swarthmore College.

Gerard Swope, president of the General Electric Company, was awarded the honorary degree of doctor of science by Rutgers College, at New Brunswick, N. J., on Tuesday, June 12.

W. A. Carter of the research department of the Detroit Edison Company spent the latter part of this week in New York City on business for his firm.

Dr. Irving Langmuir, assistant director of the research laboratory of the General Electric Company, has received the honorary degree of doctor of science from Union College, Schenectady, N. Y.

Owen D. Young, chairman of the board of directors of the General Electric Company, was given the degree of doctor of literature by St. Lawrence University, Canton, N. Y., of which he is an alumnus, on Tuesday, June 12.

E. N. Willis, secretary of the Southwestern Public Service Association, attended the National Electric Light Association convention held last week in New York and reported prosperous conditions for the utilities in his section, although the climatic conditions just now are not very favorable for the agricultural interests.

C. E. Keller, who has been with the General Electric Company since 1921, has joined the research department of the West Penn system at Pittsburgh.

W. S. Vivian has been chosen to direct the public relations work of the properties of the Middle West Utilities Company, with headquarters in Chicago. Mr. Vivian has long been engaged in this work with the telephone industry.

E. A. Olsen, superintendent of electric operation of the Alexandria (Va.) Light & Power Company, has been placed in charge of field construction in connection with the building of a 45,000-volt line between Albany, Tifton and Valdosta, Ga., part of which will be for the South Georgia Public Service Company and part for the Valdosta Lighting Company.

N. Saitoh, director of the Daido Electric Power Company, Ltd., one of the largest companies of its kind in the Japanese Empire, recently inspected the works of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, where a large part of the electrical apparatus used by the Daido company has been built. The visitor from the Orient was accompanied on his tour of the plant by H. F. Griffith, assistant to general manager of the Westinghouse Electric International Company, and Stephen Q. Hayes, general engineer of the Westinghouse company, who has been working with the Daido Electric Power Company in the extensions of its systems.

W. B. Lewis, formerly in the sales department of the San Francisco office of the Western Electric Company, is now in the Los Angeles office of that organization.

Hoyt Catlin, advertising manager of the Bryant Electric Company, Bridgeport, Conn., was elected president of the Bridgeport Advertising Club at its annual dinner on May 28.

C. H. Dahl, for the last three years statistician of the Winnipeg Electric Railway Company, has been advanced to be one of the assistants to the vice-president, A. W. McLimont.

Richard J. Johnston, formerly with the Navy Department at Washington, has been appointed illuminating engineer of the George Cutter Company, South Bend, Ind.

A. M. Jackson, Rocky Mountain district representative of the Locke Insulator Company, with headquarters in Salt Lake City, has been transferred to the Chicago office of the company.

Guy Zinck, formerly with the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., is now in the industrial sales department of the Los Angeles office of that company.

W. G. Keay, for the past four years with the Ruud Manufacturing Company, with headquarters at Detroit, has been appointed New England manager of the Eureka Vacuum Cleaner Company, with headquarters at Boston.

J. C. Jones of the Los Angeles office of the Westinghouse Electric & Manufacturing Company has been made manager of the central-station division in that territory and will also have charge of the sale of supply apparatus.

O. M. Bostwick, for ten years in charge of the advertising division of the Sprague Electric Works of the General Electric Company, is now in charge of the New York office of the advertising department of the General Electric Company.

W. W. Smith, electrical and pyrometric engineer with the Chemical Warfare Service, Edgewood Arsenal, Edgewood, Md., has resigned to enter the fan-motor department of the General Electric Company, Pittsfield, Mass., as an electrical engineer.

B. F. McIntyre has been appointed branch manager of the Cleveland sales office of the Industrial Controller Company, Milwaukee. Mr. McIntyre was formerly connected with the Canadian branch of the Robbins & Myers Company.

Carl Whitmore, formerly division superintendent of plants at Portland, Ore., of the Pacific Telephone & Telegraph Company, is now division superintendent of installations of the Western Electric Company, with headquarters in San Francisco.

W. P. Jend has been appointed manager of the merchandising division of the Detroit office of the Westinghouse Electric & Manufacturing Company to succeed F. D. Koebel, who will take up general duties in connection with both the central-station division and the merchandising division.

H. R. Sargent, formerly manager of the wiring supplies division of the Bridgeport works of the General Electric Company, has been appointed managing engineer of that division under a development plan which will create several unit divisions at the Bridgeport factory.

R. K. Evans, sales engineer with the Remy Electric Company, Anderson, Ind., has been appointed service manager of the company to fill the vacancy created by the resignation of E. E. Eby. Mr. Eby severed his connection with the Remy company to join the sales staff of the Wyatt Roller Bearing Company, Newark, N. J.

William J. Wooldridge, manager of the electrical sheet department of the Wheeling Steel Corporation and of its predecessor, the Whitaker-Glessner Company, for almost four years, in charge of manufacture and sales of electrical sheets, recently resigned. Mr. Wooldridge has not announced his future plans.

C. I. Weaver, vice-president and general manager of the Springfield (Ohio) Light, Heat & Power Company, has become fiscal agent for the American Gas & Electric Company in the operation of properties recently acquired in Urbana, Mechanicsburg, Mutual, Catawba, Cable and Woodstock, Ohio, from the Northwestern Ohio Light Company, southern division.

S. S. Sonneborn has joined the organization of the Splitdorf Electrical Company, with headquarters at the company's factory at Newark, N. J. Mr. Sonneborn was for many years general manager of the Electrose Manufacturing Company and is an expert in the molded and insulation parts field. In his new position he will take charge and supervision of molded parts of shellac, rubber and synthetic compositions.

Joseph G. Worker, combustion and stoker engineer, has joined the organization of the American Engineering Company, Philadelphia, manufacturer of the Taylor mechanical stoker. Mr. Worker is secretary of the Stoker Manufacturers' Association of the United States and has spent many years in the study of coal burning by mechanical methods and processes.

J. O. Case, formerly local sales manager of the Los Angeles office of the General Electric Company, has recently been appointed assistant local manager of that office. Mr. Case has been associated with the company since 1905, when he went to Schenectady to take the student's apprentice course. He was local sales manager at Los Angeles for two years prior to his present appointment.

Major R. W. Chandler, formerly in charge of research work for the Yale & Towne Manufacturing Company, Stamford, Conn., has been placed in charge of industrial electric truck and tractor sales, with headquarters at the factory. J. C. Morgan, formerly sales manager of the industrial truck division, has been made manager of the hoist department, with headquarters at Stamford.

Parker M. Robinson, formerly turbine engineer on the Pacific Coast for the Westinghouse Electric & Manufacturing Company, has recently joined Hunt, Mirk & Company, consulting and contracting engineers of San Francisco, entering the firm as a junior partner. Mr. Robinson has been connected with the engineering department of the Westinghouse Electric & Manufacturing Company for more than four and a half years.

H. G. Bonner, manager of the Meridian (Miss.) Light & Railway Company, a Doherty property, will leave on July 1 to assume charge of the Ohio Public Service Company, Alliance, Ohio, also part of the Doherty organization. Mr. Bonner became identified with the Doherty interests in 1913, when he became new-business manager of the electric utility in Elyria, Ohio, owned by Henry L. Doherty & Company. W. R. Phipps, who was for a number of years general manager of the Brush Electric Company of Galveston, Tex., and a well-known man in the Doherty service, will succeed Mr. Bonner in Meridian.

John R. Smith, formerly estimating engineer with the Freeman-Sweet Company, electrical contractor of Chicago, has been made vice-president and general manager of the recently organized Electrical Industrial Sales Company, Chicago. Mr. Smith was at one time estimating engineer with the Beaver Electric Company at Chicago and was largely instrumental in forming the Electrical Estimator Association in that city, of which he served as secretary in 1918 and president in 1920. The new organization with which Mr. Smith has allied himself is to serve as manufacturers' agents.

Obituary

Robert B. Weaver, owner of the Weaver Electric Company of Denver, Col., died recently of blood poisoning Mr. Weaver, who was a native of Cuthbert, Ga., went West about twelve years ago. He was thirty-two years old.

Capt. Alexander B. Guigon of Richmond, Va., died recently at his home in that city at the age of sixty-five. Captain Guigon, who had been identified with the traction business in Virginia for more than thirty years, was prominent in the merger of the Richmond Traction Company with the Virginia Railway & Power Company and at the time of his death was general counsel for the company.

Dr. Rudolph Hering, engineer, died on Wednesday, May 30, at his home in New York. Dr. Hering was formerly a member of the firm of Herring & Fuller, consulting engineers to the New York Department of Water Supply, Gas and Electricity, and had directed the installation of various waterworks and sewerage system in the United States, Canada and South America. He was seventy-six years of age.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Sentiment for Simplification Spreading

Electrical Manufacturers and Jobbers Indorse the Movement to Eliminate Excess Varieties and Reduce Stock in Supply Lines

THE electrical industry is becoming exceedingly interested in the problem of simplification. Since the Federated American Engineering Societies, at the instigation of Herbert Hoover, Secretary of Commerce, made its survey of industrial efficiency in America, published under the title "Waste in Industry," a great deal of progress has been made in many industries. But electrical men have lagged behind. There is a very wasteful degree of duplication in electrical supply lines, a vast number of obsolete and other excess varieties, because the building up of greater lines through the creation of new types and sizes has been traditional among electrical manufacturers.

Finally the jobbers took the initiative at the recent meeting of their association, at which they listened to an address by W. A. Durgin, chief of the Division of Simplified Practice of the Department of Commerce, himself an electrical man. An urgent appeal was made to the Associated Manufacturers of Electrical Supplies to invite Mr. Durgin to the meeting of that association to be held this month at New London so that something of the same background may be given to the manufacturers also. A committee was appointed to confer with the manufacturers and with Secretary Hoover in the effort to work out a progressive program of simplification which may offer an immediate measure of relief.

The following quotations from letters recently received indicate the unanimity of sentiment:

By a Wiring-Device Manufacturer.—Every time we issue a new catalog we eliminate a number of items which have become obsolete or on which the sales are so small as to not justify their being cataloged any longer. By agreeing with competitors, which I believe is not legal, more could be done, but I am not so sure that it would be of much benefit except to ourselves and possibly the jobber. The public would not be so well served.

THE action of the Electrical Supply Jobbers' Association at its recent meeting in Hot Springs, Va., in making definite recommendations for the simplification of various electrical supply lines has led to much discussion. Sentiment in favor of simplification as a matter of principle is almost universal. Difference of opinion lies mainly in the matter of application to the individual line, and here each manufacturer is apt to feel a little hesitancy for fear business will be lost by the dropping of numbers that are selling even in small quantity, although there may be other things and more popular devices available that practically duplicate them.

The accompanying quotations are taken from a large number of letters commenting on the general situation and indicate how universal the belief is becoming that "something should be done" to simplify the electrical supply line.

On surface switches we make an open base a closed base, plain and indicating. Now, as far as breaking the current is concerned, one of those would be all that would be necessary. There are different uses, however, for each of the four kinds and all four kinds sell in reasonable quantities. Obviously, though, it would be an advantage to us to manufacture just one of the four, and for the jobber to carry but one of the four. As you undoubtedly know, we could not exactly do that, because the public would demand the other three and buy them from some one else.

We believe the agitation good and are co-operating and mean to co-operate along the lines suggested.

By a Tool Manufacturer.—We have been alarmed at the steadily rising price of labor, material and the products of manufacture. When we remember the distressing effect that followed the rapid rise in all commodities after the war and the collapse in business which followed, from which we are only just recovering, the present condition makes us apprehensive, and it is no doubt causing anxiety and possibly fear in the minds of business men everywhere.

We have given and are giving a great deal of consideration to labor-saving devices and ways and means of reducing costs of production which would enable us to place our line in the hands of the jobber, dealer and user at the lowest possible cost to them.

With this end in view, we have been considering the advisability of reducing the variety or styles of tools made by us, standardizing on those that are most popular and valuable to the trade, and diverting all of the business to them, in this way getting the benefit of quantity production.

We believe that this would result to the advantage of the jobber, dealer, user and ourselves and would surely enable us to reduce the present price on the tools we continue making, whereas under present conditions an advance in price would be absolutely necessary.

By a Conduit Manufacturer.—We are eliminating superfluous or excess varieties of fittings and have been doing it for some time. This, of course, would not apply to many of our leading lines, such as rigid conduit armored conductors, non-metallic flexible conduit, rubber-covered wire, brackets, etc., but it does apply to outlet boxes and such fittings, and we heartily agree with the principle at issue that manufacturers should take the initiative in eliminating excess varieties to the fullest extent possible.

We have noted a recent article advocating the elimination of enameled conduit and stating that zinc-treated conduit should answer all purposes as being a better product. In a general way there may be a good deal of truth in this statement, but, as a matter of fact, there are many places where conduit is installed which require an enamel protection—places where the surrounding conditions would readily corrode a zinc-treated conduit.

We merely mention this condition to indicate that on a program of elimination of excess varieties those not thoroughly posted might think that elimination could take place in some lines where conditions would make it impracticble or inadvisable.

By a Wiring-Device Manufacturer.—We are and have been strongly opposed to the multiplicity of articles in our line which are not really essential; in fact, the new catalog on which we are working will eliminate a few articles, thus further simplifying our line, and those articles which will be added are for purposes which do not duplicate except in so far as the rulings in some cities—for instance, Chicago—may require.

The only way in which manufacturing costs can be cut down to the minimum is to simplify the line as much as possible, and this, of course, means the elimination of all articles which are really duplicates of others serving practically the same purpose.

Of course as matters stand, the only thing that we can do is to use our best efforts in connection with our own line and in selling our product to induce our customers as far as possible to use standard material, and we believe that if all manufacturers will work with this idea in mind the problem to which you refer will in a large measure be solved in the not far distant future.

By a Heating Appliance Manufacturer.—We believe in the importance of standardization and simplification of lines as far as possible. In January, 1920, we had 477 cataloged items in the line. On Jan. 1, 1923, we had 206. This was accomplished by eliminating the manufacture of the same appliances under more than one trade name and by eliminating the sizes of product for which there was little demand. Actual standardization was greater than the figures show, as during this period new items performing new functions or improved functions were added.

In all of our newer product the question of standardization of parts or interchangeability of parts, as, for example, range-heating units or radiant-heater units, has been carefully watched, so that simplification has been carried further than is indicated by the number of cataloged items. This is an aid not only to the manufacturer but also to the entire trade, as it reduces the stocks of repair parts to be ordered or carried by our customers.

By a Wiring-Device Manufacturer.—We are in entire sympathy with the simplification idea. In the next reprint of our wiring-device catalog we will eliminate a number of existing devices, all of which are slow movers and were probably added originally to meet apparent competition.

We feel that almost every line is allowed to expand without due consideration of the necessity for various devices. We know as a matter of fact that this is true of many of our controller devices. This matter is constantly receiving consideration even on this line of apparatus, and we are continually removing devices from our standard catalog lines and putting these in semi-standard form in the hands of our engineers to meet special needs.

We feel that anything which the trade papers can do to bring continual pressure on the manufacturers to eliminate unnecessary devices is in the end going to reduce manufacturing costs and simplify the general distribution problem. Pride undoubtedly causes many manufacturers to expand their lines unnecessarily thus putting in the hands of the trade extensive catalogs which, at least from the appearance standpoint, will "stack up" with the catalogs of their competitors. This is economically wrong, and we believe the movement is now progressing in the right direction.

By a Jobber.—Owing to the existence of too many manufacturers' styles, if purchasing is not done with the greatest care and judgment today a jobber will find at least 25 per cent of his stock very slow-moving and eventually a great part of the 25 per cent will become dead. In other words, a jobber carrying a stock of $100,000 will actively operate on 70 to 75 per cent of this merchandise. Two years ago we decided on a policy of limitation and elimination of slow movers, but it has been a very hard job to get rid of these slow movers.

I am very glad, indeed, that the manufacturers are coming to an understanding as to excess varieties of goods, for in helping themselves they can certainly help the jobber by reducing his and their investment.

I believe that switch boxes could be simplified. Our purchases at the present time are limited to four styles which take care of more than 90 per cent of our requirements.

As regards pole-line hardware I am of the opinion that 50 per cent of the styles commonly manufactured could be eliminated without working a hardship.

There is another line that few jobbers have been successful in marketing, and that is fixtures. In twenty-two years I have been in and out of it four times and at the end of each discontinuation have found that the left-overs equaled or exceeded the profit which we had made or thought we had made, and it is all caused by manufacturers changing the styles. I have often remarked that the style of lighting fixtures changed about as often as the styles of women's hats.

By Another Jobber.—Every jobber and manufacturer in the electrical industry should be glad to help remedy the very poor conditions existing in our business because of the many duplicates and obsolete items manufactured and listed

We feel that conduit-box and porcelain-insulator lines are particularly burdened with obsolete and excess varieties. But it is our firm belief that results of great worth could be accomplished if the manufacturers can be induced to co-operate.

We have felt the burden of listing obsolete and excess varieties in our 800-page catalog, and to help us overcome the difficulties encountered have listed in our salesmen's price books only the catalog numbers which we carry in stock so our salesmen are able to tell their customers whether we have what they want, and the chances are that if we do not list the number called for, they help the customer pick out something we have in stock which will answer his purpose as well This saves time for the customer and ourselves in each department as well as for the ultimate purchaser, who is waiting to have his job finished in a hurry.

By Another Jobber.—To my mind the simplification of lines is absolutely essential to the future prosperity of the electrical jobbing business. I am convinced that we probably shall never again enjoy the same margins of profit on merchandise that we have enjoyed in the past; therefore, if we are to do our part in the proposed scheme of reducing the costs of distribution, the reduction of variety and simplifying of lines is necessary to enable us to secure a proper turnover.

It appears impossible, at least for the present, for the electrical jobber to reduce his overhead. A recent analysis of our operating expenses developed the fact that our payroll for the year 1922 was 43⅛ of the total operating expenses. For the first three months of this year it has increased to 47⅞ per cent and this does not include the salaries of the executives. Our case is not exceptional by any means, for I find in making a comparison with others that their payrolls exceed 50 per cent of the total expenses.

I think we jobbers at least are all agreed that we are suffering from too great variety in almost every article we handle. The question is who is to do the job. The jobbers of this country have received little support from the manufacturers.

By Another Jobber.—I had occasion as far back as 1910 to get into this subject actively in connection with lightning arresters for low-voltage distributing systems, and the reduction in numbers and types not only saved every one concerned a considerable amount of money but also made the sales exploitation of this line much more accurate and intensive.

I should say that line hardware, conduit fittings, lamps or fuses would all give plenty of field for study in the elimination of excess numbers.

We have simplified our business by eliminating duplicate lines, and we are making it a practice to put nothing in the catalogs of our salesmen except what we think they should sell. We should be greatly assisted in our efforts, of course, if manufacturers would discontinue illustrating things that people do not really need but may think they require.

By Another Jobber.—With the co-operation of the manufacturers and the simplifying of their lines, the jobbers would release from frozen stocks many thousands and thousands of dollars that should be reinvested in lively fast-moving commodities that would permit the jobber to carry a better stock, to represent the manufacturers better and to serve the consumers better. If the executives would get into this proposition personally themselves, instead of delegating it to one of their understudies, they would marvel at their ignorance and would be amazed at the duplications that would be discovered in the lines they are carrying and at the duplication and obsolesence that creep into their stocks of merchandise at all times.

Eleven Organizations Aid in Standardization Work

AID of eleven business organizations in the furtherance of the Commerce Department plan for the formulation of purchase standards specifications was pledged on June 11 at a conference of representatives of these bodies with Secretary Hoover at Washington.

Addressing the representatives of the organizations, who are to compose an advisory committee, Mr. Hoover declared it was the idea of the department to make a beginning of the scheme of standardizing purchase specifications by adopting definitions covering all federal government purchases, which would include between 2,500 and 5,000 articles. The scheme, he said, would be broadened to include state and municipal government purchases and public institutions.

Mr. Hoover emphasized that commercial interests would not be required to accept the standards adopted for general use, but was of the opinion that commercial practices would follow the government lead.

The organizations represented at the conference were the American Engineering Standards Committee, the American Society for Testing Materials, the National Association of Purchasing Agents, the American Hotel Association, the United States Chamber of Commerce, the National Association of Manufacturers, the National Business Editors' Association, the Federal Specifications Bureau, the Association for Government Service, the American Electric Railway Association and the Society of Automotive Engineers.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

MORE price decreases in the wiring lines are noted in this week's reports. Despite a slightly stronger copper market last week, prices of flexible armored conductor have fallen 10 per cent. Brass and bronze products for electrical manufacture generally are firm and are subject to the normal demand.

Added use of rubber composition products in the wiring-device line in preference to porcelain specialties is causing some concern among the smaller makers as regards stocks. The latter say stocks of this effective product are noticeably lower, and higher manufacturing costs are feared. However, some leading authorities in the wiring-device field say these fears by the smaller makers have no real foundation and that when purchasers of their different lines have come to accept more composition products in place of porcelain they will manufacture this composition for their own needs and will keep out of the open market.

Business of the electrical industry throughout the United States is continuing at the steady gait of the last three weeks, with normal stocks and slightly lower prices.

Aspects of Electrical Machinery Exportation

UNBUSINESSLIKE methods as a means of securing profitable orders abroad should be unnecessary, according to opinions advanced at an electrical machinery conference held recently in Boston in connection with the New England foreign trade convention. In an informal discussion of present conditions in exporting it was brought out that in the sale of American electrical machinery overseas deferred payments by the foreign buyer ought not to be inevitable. Such equipment represents a substantial capital investment as compared with ordinary merchandise like haberdashery.

South America is growing fast in inquiries for electrical instruments for the automotive industry. At present, in the machinery field, the competition of Great Britain is acute in textile lines, and through co-ordination of interests British manufacturers are taking machinery business in some cases at very low profits or at actual losses. It was pointed out at this conference that American manufacturers would do well to plant themselves through reliable representation in various countries and to force their competitors to take business at or below cost if necessary. Neither English nor German manufacturers can keep up this kind of competition indefinitely, it was pointed out. It is very desirable for American manufacturers to consider how they can work effectively together in connection with foreign trade, for the association of British manufacturers is pointing the way toward very efficient team play in the overseas trade problem solution.

Chicago Electrical Business Shows Slowing-Up Tendency

BUSINESS in the Chicago electrical trade continues about the same as last week, with a tendency toward slowing up rather than increasing. No advances in prices were announced, while a reduction of $5 per 1,000 ft. in flexible armored conductor became effective June 7. Although electrical jobbers report that business in general is a trifle slow, they state that the number of anticipated contracts upon which they have been asked to figure this week is increasing. The building situation remains much the same, which accounts for the lack of active buying.

Demand for socket appliances is normal, with noticeable sales at this time of toasters and waffle irons. Hollowware and iron sales are also normal. Sales for this year to date are about the same as last year, with very little increase. The warm weather in this territory just after the first of June caused an active demand for fans, and distributors' stocks were depleted temporarily. However, the cold spell which immediately followed stopped the active sale of this material. Fan manufacturers look forward to a very prosperous season this year. One manufacturer, in conjunction with a large distributor in this city, is putting on a novelty advertising campaign. A fan three times the size of the largest one made for sale is to be mounted on a truck, which will carry advertising placards through the residential sections of the city.

Eastern Sections Report Steady Volume of Trade

GENERAL electrical business holds up well in the Eastern territory, with improving deliveries and well-rounded stocks on jobbers' shelves. Railroad embargoes are no longer causing trouble. Prices of flexible armored conductor fell about 10 per cent last week, and bare and weatherproof wire were weak, although Monday prices were a bit firmer on copper. Appliance sales continue to run far ahead of last year's. Building contracts in New England totaled $37,877,000 for May, a gain of 11 per cent over April and 14 per cent over May of last year. For the week ended June 5 these contracts totaled $7,655,800, compared with $6,666,500 for the same week in 1922. A spurt in fan sales marked the early part of last week. Labor conditions are good in the main, barring an unsettled situation in the telephone operating field and some difficulties in the shoe industry. Money is easy and contractor-dealers are very busy. Central-station outputs are growing steadily. Manufacturers of automatic substations and generating plants are figuring on a number of important "propositions" in this section.

Safety Switch Sales Compare Favorably with Six Months Ago

SALES of safety switches are said to compare very favorably with those of six months ago. Deliveries are larger than normal, and the outlook for the next six months, according to leaders in the field, is not very good. There have been some recent advances in prices, but manufacturers say they are unable to predict just what further changes may come in the near future.

San Francisco Appliance Sales Are Reported Brisk

MAY, 1923, building permits in the four principal California cities totaled: Los Angeles, $18,926,881; San Francisco, $4,928,986; Oakland, $2,373,020, and San Diego, $770,515. May, 1922, totals were: Los Angeles, $9,327,504; San Francisco, $4,377,066; Oakland, $2,243,745, and San Diego, $677,580. Despite encouraging increases in permits, building in northern California is rather slow, with comparatively few big jobs for immediate construction.

Sales of large appliances are slower, but smaller appliances are moving faster, principally because of the stimulus of "June Bride Week." Irons and percolator sets are selling well.

Several large orders are reported, such as a fifty-thousand-dollar high-tension insulator order from a California company and orders for several large rubber-covered wire assortments. Prices have apparently reached a temporary equilibrium.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.034	$0.0326	$0.0256
Cold finished shafting, per lb.	0.042	0.042	0.0328
Brass rods, per lb.	0.1850	0.1913	0.1533
Solder (half and half), per lb.	0.2862	0.2987	0.22
Cotton waste, per lb.	0.1231	0.2812	0.104
Washers, cast iron (⅛-in.), per 100 lb.	4.66	4.66	4.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	2.96	3.11
Machine oil, per gal.	0.349	0.349	0.383
Belting, leather, medium, off list	42½%	42½%	46½%
Machine bolts, up to 1-in. x 30-in., off list	44½%	44½%	62½%

Exports of Electrical Glassware, Generators, Arc Lamps, Flashlights, Etc., from the United States During 1922

(Original data supplied by the Bureau of Foreign and Domestic Commerce)

Exports of Electrical Glassware, Generators, Arc Lamps, Flashlights, Etc., from the United States During 1922

(Original data supplied by the Bureau of Foreign and Domestic Commerce)

		Globes and Shades for Lighting, Dollars	Electrical Glassware, Except for Lighting, Dollars	Electrical Porcelains, Dollars	Carbons for Electrodes and Batteries, Dollars	Generators Direct-Current		Alternating-Current Under 2,000 Kw., Dollars	Arc Lamps, Dollars	Incandescent Lamps		Flashlights, Dollars	Radio & Wireless Apparatus, Dollars	Telegraph Apparatus, Dollars	Telephone Apparatus, Including Telephone Switchboards, Dollars	Copper Rods, Dollars	Wire of Brass or Bronze, Dollars	Poles, Telegraph, Trolley and Electric Light, Dollars	Cross-Arms, for Telegraph, Telephone and Trolley Poles, Dollars		
						Under 500 Kw.	500 Kw. and Over			Carbon-Filament	Metal-Filament										
						Dollars	Dollars			Dollars	Dollars										
1	Azores	17		2,430	131	4,233					68		110	124						Azores	1
2	Belgium	678	2,146	13,377	23,472	691					1,334		7,439	146	49,355					Belgium	2
3	France	1,398	91	42,001	12,156	48,876	13,983		28	2,889	4,746	2,175	3,018	2,688	17,890					France	3
4	Denmark	210			63	491				853	644		2,421		2,408	65,252	567			Denmark	4
5	Greece	186		100						61	15									Greece	5
6	Iceland & Faroe Islands		15												333					Iceland & Faroe Islands	6
7	Netherlands	2,045	544	10,659	5,880	698				15	89	554	9,931	14,755	24,094					Netherlands	7
8	Norway	1,151	185	86,560	17,587	4,777	1,760	1,260	59	128	854	819	10,401		5,219	448				Norway	8
9	Spain	346	17	134,201	59,566	2,488	27,272	5,808		818	3,346	3,854	655		53,871					Spain	9
10	Sweden	624	320	25,276	21,196	759					285	2,659	1,746		28,886		900			Sweden	10
11	Switzerland	24		9,511	902	2,863							1,839	1,200	34,799		4,500			Switzerland	11
12	England	46,738	7,700	9,009	74,991	23,203	1,775	1,078	838	4,455	3,770	7,462	317,919	98,463	535,405	254,432	532			England	12
13	Scotland	281	67		2,525							133	100		3,048					Scotland	13
14	Canada:																			Canada:	
	Maritime Provinces	2,804	3,551	5,203	486	11,868		25		44	631	480	11,260	9,241	21,481	240	58	1,600		Maritime Provinces	14
15	Quebec and Ontario	175,248	81,678	314,768	1,239,770	83,710	125,470	11,932	862	19,794	71,209	13,023	632,476	59,961	430,873	256,416	15,831		45	Quebec and Ontario	15
16	Prairie Provinces	11,761	13,065	15,243	5,117	5,707	11,560	2,906	244	95	233	735	14,221	11,968	96,628	76				Prairie Provinces	16
17	British Columbia and Yukon	6,679	3,397	12,882	697	6,745		715	115	169	5,236	1,136	32,063	5,774	14,562	320	329			British Columbia and Yukon	17
18	British Honduras	956	474	729	62	3,015				445	2,201	780	42		3,581					British Honduras	18
19	Costa Rica	2,040	172	2,526	1,757	2,373			23	440	3,586	438	410	1,683	5,332					Costa Rica	19
20	Guatemala	1,052	3,488	2,194	373	2,052	155	850	126	4,245	6,681	1,169	277	4,772	6,711	31				Guatemala	20
21	Honduras	21,266	23,303	4,008	371	3,211				2,583	8,626	4,291	8,323	46	14,402	17				Honduras	21
22	Nicaragua	419	320	685	7	2,006			40	47	4,155	1,157	77	31	9,923					Nicaragua	22
23	Panama	2,512	372	5,235	999	1,266				402	8,801	1,019	2,734	26	8,085	210	210			Panama	23
24	Salvador	318	331	464	582	1,801		97		30	7,421	330	128	240	1,043		14			Salvador	24
25	Mexico	20,981	11,365	60,074	4,521	41,315	12,070	14,272	357	11,787	222,248	42,012	91,926	22,474	184,554	101	151	655	1,433	Mexico	25
26	Newfoundland and Labrador	1,271	3,149	2,699	69	1,698		28		126	13,644	822	786	14,266	10,287					Newfoundland and Labrador	26
27	Bermuda	1,267	261	338	60	3,518			3	629	1,169	827	265	394	3,406					Bermuda	27
28	Jamaica	582	181	2,110	150	527	675			597	6,003	3,524	55	609	5,101					Jamaica	28
29	Trinidad and Tobago	787	248	572	625	1,749				200	10,600	2,147	121	27	14,222					Trinidad and Tobago	29
30	Other British West Indies	298	217	1,879		1,540	200	75		28	6,663	1,443	7,310		21,140	19				Other British West Indies	30
31	Cuba	22,029	2,023	22,896	4,541	12,347	50,770	102,946	85	2,930	140,870	7,705	112,302	2,735	344,145	655	1,235	1,332	581	Cuba	31
32	Dominican Republic	479	148	1,148	53	4,603	102			99	13,751	2,197	491		3,057		32		863	Dominican Republic	32
33	Dutch West Indies	463	18	84		80					968	516			541					Dutch West Indies	33
34	French West Indies	56									107	87								French West Indies	34
35	Haiti	447	496	1,331	346	98			74	321	3,365	850	106		338		9			Haiti	35
36	Argentina	5,450	8,633	15,182	2,823	11,484	1,492	11,088		966	160,456	84,518	650,509	5,441	127,887					Argentina	36
37	Brazil	17,873	9,935	39,199	17,487	21,800	20,662	3,561	85	9,413	36,826	4,994	82,524	21,768	325,346	20	1,363			Brazil	37
38	Colombia	2,229	1,002	6,823	1,099	28,468	2,060	13,315		1,905	42,624	6,378	26		76,805					Colombia	38
39	Ecuador	702	130	1,532	542	780	19,475	4,973	135	423	3,646	618	221	1,223	7,774					Ecuador	39
40	Bolivia	192	28	177	7	1,690	2,140				719	17			765					Bolivia	40
41	Chile	2,207	247	65,286	8,948	11,822	245,883	570		7,668	37,411	1,655	7,095		15,052					Chile	41
42	Peru	651	605	18,504	1,900	9,143	10,690	5,225		544	14,920	1,457	53	1,196	78,404		1,699			Peru	42
43	Venezuela	1,937	5,110	4,180	2,260	23,789	2,195	681	5	631	23,644	3,153	8,340		39,147	499				Venezuela	43
44	Hongkong	2,806		388	3,783	2,009				10	1,420	2,790	2,039		408					Hongkong	44
45	Japan	7,983	1,256	94,693	95,434	52,035	420,871	61,305	1,020	85	3,470	1,842	41,638	23,185	388,582			4,091		Japan	45
46	British India	14,386	602	13,098	322	12,504	7,400			878	18,200	11,563	89		263,234					British India	46
47	China	15,343	1,200	3,104	3,074	48,970	90,073	16,268		45	20,124	2,856	6,898		214,799					China	47
48	Philippine Islands	4,334	1,489	12,713	6,933	27,960	1,059	1,841	21	496	20,469	13,670	34,166	641	97,652					Philippine Islands	48
49	Siam	592	332	9,135			260				1,041		132	995			92			Siam	49
50	British West Africa	598		229		775					144	39			79					British West Africa	50
51	British South Africa	5,172	841	675	4,911	1,239		529		42	68,548	3,303	1,263	25,808	2,913					British South Africa	51
52	Australia	30,777	5,642	117,545	34,851	20,654	10,710	3,646	5,503	2,404	97,833	5,917	25,293	1,682	353,932					Australia	52
53	Dutch Guiana										207	233								Dutch Guiana	53
54	Turkey in Europe	60		140							240				44					Turkey in Europe	54
55	New Zealand	10,675	1,178	26,846	799	4,075	2,985	823		14	28,308	5,728	28,901	8,595	133,272					New Zealand	55
56	Italy	2,724		12? 14	194,668	884				12	389		425		84,518					Italy	56

March and April Heater Cord Sales Exceeded Those for May

PRESENT sales of heater cords are said to be approximately the same as six months ago, although the volume of business handled by manufacturers during March and April was somewhat larger than that for the month of May and the first week of June.

Deliveries are slightly subnormal at the present time, there being a large demand for heater cord, which is likely to continue for at least six or eight months owing to the great number of homes which have been built during the current year and the necessity of having cords for the appliances which will be used in them.

Prices generally have not changed, although the market prices of raw materials have declined within the past five or six weeks. This decline however, has been more than offset by the increase in production costs due to larger wages and the lessened efficiency which invariably exists when labor is at a premium.

Germany Is No Longer a Serious Competitor

GERMANY is no longer a serious competitor in the machinery field, declared R. A. Lundquist, chief of the electrical equipment division of the United States Bureau of Foreign and Domestic Commerce. Present acute competition is British. American machinery exports last year totaled about $186,000,000 against $50,000,000 before the war. Australia, South America and Asia are expanding their consumption of foreign-made products, and under present conditions the better policy is to "put the soft pedal" on European trade and to concentrate upon these other continents.

The United States should, with proper cultivation, obtain say half the pre-war foreign trade of Germany in machinery lines. Before the war Germany handled about 45 per cent of international trade. Great Britain 25 per cent and the United States 20 per cent. British labor costs are much higher than before; the European situation is complicated by political uncertainties, and disorganizing conditions are being faced by many foreign manufacturers. As the years pass the United States must expect to meet more competition from continental Europe as it recovers equilibrium. In ten years the exportation of high-grade and carefully finished machinery from France is likely to develop. By the terms of the Versailles treaty France received two million more tons of steel than was formerly delivered, and the manufacture of high-grade engineering products is in line with French abilities.

During the conference the point was brought out that a thorough understanding of the terms and principles underlying patent laws in foreign countries is essential to American manufacturers. In South America the laws give priority of application rather than priority of use the preference. A movement has begun, although it is thus far rather weak, to secure uniform patent laws in various parts of the world.

The Metal Market

THE sentiment in the non-ferrous metal market is somewhat better than a week ago, although business has not been active and prices show little change. The news from Europe seems a bit more encouraging and conditions in that market have been the governing factor recently

The last few days have witnessed some improvement in the demand for copper for the export trade. The surprising thing, according to producers, is that sales are being made at a fraction above the domestic price, which is now quoted at 15 cents a pound. The Copper Export Association is handling most of the business, and while the official price could not be learned, it is understood to range between 15.25 cents and 15.30 cents, c.i.f. European ports. The greater part of the demand at the present time, it was said late last week, is coming from France, but Germany continues a buyer in fair amounts, while other foreign countries are now taking more than they have done in recent weeks.

NEW YORK METAL MARKET PRICES

	June 7, 1923 Cents per Pound	June 14, 1923 Cents per Pound
Copper, Electrolytic	15.00	15.00
Lead, Am.S.& R. price	7.25	7.25
Antimony	8.00	7.75
Nickel, ingot	27.00 to 30.00	27.00 to 32.00
Zinc, spot	6.35	6.37
Tin, Straits	42.20	41.90
Aluminum, 98 to 99 per cent	26.00	26.00

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Electrical Industrial Sales Firm Organized in Chicago

The Electrical Industrial Sales Company, Inc., is one of the latest organized Chicago companies to serve as manufacturers' agents. This company was incorporated for $10,000 on June 1, and an office of 960 sq.ft. floor space has been taken in the America Fore Building, 844 Rush Street, Chicago. John R. Smith, vice-president and general manager, said: "Our first connection with a manufacturer is with the Kuhlman Electric Company, of Bay City, Mich., and we will handle its complete line of transformers, including its new series disconnecting street-lighting type. In the meantime we will be on the lookout for other manufacturing connections, but intend to take our time in choosing a specialized line supplementing the street-lighting business."

Westinghouse Electric Creates New Engineering Department

The creation of a new engineering department in the organization of the Westinghouse Electric & Manufacturing Company has been announced by R. S. Feicht, director of engineering. The new department will be known as the porcelain insulator and transmission engineering department, and C. L. Fortescue, well known in electrical engineering, has been appointed manager.

This new department, according to the announcement, will handle the design of line insulators and other work which may be assigned to it from time to time in connection with transmission problems. "The rapid growth in the porcelain business and the steady increase in the number of problems growing out of the transmission of high voltages for great distances has necessitated the creation of a department to handle these problems," declared Mr. Feicht, who made it plain that, in connection with transmission problems, the new department will make studies and analyses of these problems, but will not be concerned with the design of large transmission systems.

Anaconda Copper May Acquire National Conduit & Cable

The Anaconda Copper Company is expected to acquire the properties of the National Conduit & Cable Company within the near future. The latter company is now in the hands of the court, and a committee of stockholders and bondholders was organized some time ago for the purpose of endeavoring to rehabilitate or refinance the property. Thus far these efforts have not met with success. The committee recently received an offer of $700 for each $1,000 bond of an issue of $4,168,500 of the 6 per cent bonds outstanding, and it was learned last week that the Anaconda organization had made the bid.

Acquisition of the bonds by Anaconda, it was pointed out, would place it in a favorable position to bid in the property at a sale, while the placing of the entire issue in its hands might be expected to hasten the foreclosure of the mortgage securing the bonds. At $700 per bond the cost to Anaconda would aggregate about $2,900,000, but expenses of foreclosure and liquidation are expected to bring the total to approximately $3,000,000.

The National Conduit & Cable Company has a large copper wire and rod plant at Hastings-on-Hudson, as well as a department which specializes in the

manufacture of brass products. The rod and wire mill will help to round out the plans which the officials of the Anaconda company have had in mind for some years and which began to materialize with the acquisition of the American Brass Company in the early months of 1922 and the Chile Copper Company early this year. The properties which Anaconda contemplates taking over are expected to be reorganized.

The stockholders' protective committee recently increased its efforts to save the organization for the benefit of the interest which it represents. Shortly after the offer of $700 per bond had been made the stockholders requested the bondholders to join with them in efforts to save the properties so that the bondholders might get a hundred cents on the dollar for their interest and the stockholders conserve their property. Since then the greater part of the bonds have been deposited with the National City Bank, which is depositary for the bondholders' committee. Unless the stockholders can muster sufficient funds to outbid the Anaconda at a public sale, the latter is expected to take over the properties.

Wakefield Brass Expansion

The F. W. Wakefield Brass Company of Vermillion, Ohio, is erecting an addition to its plant which will increase manufacturing space about 20 per cent. This addition is made necessary to take care of increased production of its "Red Spot" hangers and other lighting specialties, the demand for which has grown steadily for twenty months.

Billings of Allis-Chalmers Reach $2,000,000 a Month

Billings of the Allis-Chalmers Manufacturing Company, Milwaukee, are now running at the rate of $2,000,000 monthly or $24,000,000 annually. While total billings for the first quarter amounted to $5,221,000, April and May billings were approximately $2,000,000 monthly, or a total of $4,000,000, and at the present rate of operations the second quarter's total should approximate $6,000,000. Total billings last year were $20,794,000.

The labor shortage is restricting the higher percentage of operations. Were labor to become more plentiful, Allis-Chalmers would undoubtedly speed up operations as the outlook for continued good business by this company is promising. As it stands, unfilled orders are now around $12,000,000 and provide enough business to keep the plants running until December at the present rate of operations.

Present rate of billings of $2,000,000 monthly is taxing the company's plants less than 75 per cent of capacity. It is estimated that present plant facilities have a potential capacity of handling $36,000,000 worth of business annually. In 1918, the company's banner year, plants of the company billed $35,000,000 worth of goods.

Hurley Machine Report Is Most Favorable

Edward N. Hurley, chairman of the board of the Hurley Machine Company, Chicago, in submitting his annual report to the stockholders of the company, stated that there is no intention of increasing the price of its product.

The balance sheet and income statement for the year 1922 presents a very favorable report on the operations of the company during that period. The year closed with cash in banks and United States certificates of indebtedness totaling $1,529,786, and the inventories of $1,061,673 at the close of business Dec. 31, 1922, show an increase of but $80,364 over the inventory value of Dec. 31, 1921, although the volume of business in 1922 far exceeded that of 1921.

The current liabilities as at Dec. 31, 1922, consist only of those obligations incurred during December, there being no outstanding bank or other loans. The ratio of current assets to current and accrued liabilities was 4.43 to 1.

The net sales of electric washing and ironing machines for the year 1922 show an increase of 27 per cent over the sales for the previous year. The net income for the year 1922 after all charges, including federal taxes, amounted to $635,942, or an increase over the profit of 1921 of 48 per cent. The net income of 1922 after taxes represents 13 per cent on the net sales, compared with 11½ per cent earned on the net sales in 1921.

No increases in the prices of product were made in 1922. Likewise no increases have been placed in effect this year, nor are any planned.

The prospects for the company during the year 1923 are very promising. Orders for product received during the first four months of the year exceed $3,000,000 in value. For the period Jan. 1 to April 30, 1923, billing to customers amounted to $2,316,002, an increase of $831,030 or 56 per cent, over the shipments billed during the same period in 1922. Owing to this increased volume the net profit for the first four months of this year after providing for federal taxes represents an increase of 108 per cent over the net profit for the same period in 1922.

Pennsylvania Crusher Company Moves Pittsburgh Office

In order to provide more adequate facilities for its volume of business in the Pittsburgh district, the Pennsylvania Crusher Company has recently moved its offices from the People's Bank Building to more adequate quarters in the Oliver Building, where operations will be continued under the management of H. M. Hallett as district manager.

The business of the Pittsburgh office is largely concerned with "Pennsylvania" coal-preparation machinery for mines, by-product coke plants, central stations and industrial power plants, and with heavy-duty primary and secondary crushers for large cement and lime plants.

Sturtevant Acquires Large Plant in Wisconsin to Aid Business

The B. F. Sturtevant Company, Hyde Park, Boston, manufacturer of motors and ventilating equipment, announces that it has acquired the plant of the Wisconsin Engine Company, Corliss, Wis. This new acquisition covers nearly ten acres and the buildings have approximately 150,000 sq.ft. of floor space.

A full manufacturing and engineering staff will be maintained and closer co-operation given to Western customers. The situation at Corliss will make a substantial reduction in transportation costs.

Shipping facilities are ample as Corliss is on the main line of the Chicago, Milwaukee & St. Paul Railway and is the junction through which trains pass almost every hour between Chicago and Milwaukee. It is also the only express stop on this 85-mile run. Racine also, with her lake ports, is only 6 miles east. Connection may be easily made with all the principal lines east and west, thereby making Corliss ideal from a shipping standpoint.

The new plant will be under the same direction as the other factories at Hyde Park, Galt, San Francisco and Philadelphia with E. N. Foss as president. Harry W. Page has been selected as general manager and will be in entire charge of the Wisconsin plant.

The C. M. Hall Lamp Company, 1035 East Hancock Avenue, Detroit, manufacturer of electric lamps, has plans for a two-story addition, 80 ft. x 172 ft., estimated to cost $80,000.

The Semegra Manufacturing Company, Inc., Utica, N. Y., recently incorporated under the laws of New York State for $6,000, announces that it will engage in the manufacture of electrical fixtures. Directors of the company are Gay H. Brown, M. C. Halsey and M. G. Hubbard, Jr., all of Utica.

The Keps Electrical Supply Company, 961 Liberty Avenue, Pittsburgh, has leased two floors in the building at 967 Liberty Avenue for proposed expansion in operations.

The Pickett Storage Battery Company, Greensboro, N. C., plans for the rebuilding of the portion of its works recently destroyed by fire with loss estimated at about $40,000. including machinery and equipment.

The Ray Battery Company, Ypsilanti, Mich., has been purchased by Arthur Jordan, Indianapolis, owner of the Detroit Battery Company, and the Disco Electric Manufacturing Company, Detroit. The Detroit Battery Company will become affiliated with the Ray Company, and the merged concerns will be known as the Arthur Jordan Battery Company, Ypsilanti, under the management of T. H. Lavier.

Foreign Trade Notes

PROPOSED WATER-POWER DEVELOPMENTS IN ITALY.—A concession to develop 8,577 hp. from two waterfalls and to erect two power houses on the River Serio, in the Province of Bergamo, has been granted to the Società Italiana Ernesto de Angeli, Milan. The Società Anonima Industrie Reunite di Filati of Bergamo has been granted a concession to develop 2,502 hp. from the same river. Other concessions for water-power developments have been granted as follows: To the Società Marchigiana di Elettricità of Recanati, to develop 3,784 hp.; the Società Unione Esercizi Elettrici, Province of Pesaro, 1,712 hp.; the Società Anonima Idroelettrica Rivallese, Province of Potenza, 5,000 hp., and the Consorzio Intercomunale Destra Piave, Nervesa, Province of Treviso, 2,652 hp., from two waterfalls on the Piave River.

PROPOSED ELECTRICAL PROJECTS IN FRANCE.—Application has been made by the Syndicat Intercommunal de Saint André de Corcy for a concession to distribute electricity in seventeen communes of the department of the Ain. Petitjean Frères, Montagney (Doubs), manufacturers, have petitioned for a concession to furnish electricity to twenty-four communes, four of which are located in the department of Haute Saône. Plans are now being prepared to supply electricity in fifty-seven communes in the department of the Allur. Energy will be supplied to thirty of these communes by the Scieries et Usines Hydro-électriques de la Sioule; the remainder will be served by the Société d'Electricité Générale de Saint-Etienne.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Stockholm, Sweden (No. 6,739), for electrical appliances. An agency is also desired in Stockholm (No. 6,741) for electric and gas lighting appliances.

Purchase is desired in Habana, Cuba (No. 6,794), for equipment for lighting plant.

An exclusive agency is desired in Johannesburg, South Africa (No. 6,784), for radiophone sets and equipment.

Purchase is desired in Brussels, Belgium (No. 6,713), of leaded iron strips for insulation tubes and for red rolled-copper wire.

Purchase is desired in Aguascalientes, Mexico (No. 6,754), of bare copper wire.

Purchase is desired in London, England (No. 6,723), of vacuum cleaners, etc.

ELECTRIC EQUIPMENT FOR POWER STATION, WORCESTER, SOUTH AFRICA. —Tenders will be received until Aug. 2 by the City Council of Worcester, South Africa, for an additional electric generating plant for the municipal power station.

ELECTRIC PLANT FOR RIVERSDALE, SOUTH AFRICA.—Tenders will be received by the Municipal Council of Riversdale, Cape Province, South Africa, until July 31 for an electric generating plant, distribution material, meters, etc.

New Apparatus and Publications

ALLOYS.—"Alloys for Electrical Resistance" is the title of data book R-23 issued by the Driver-Harris Company, Harrison, N. J., in which it describes its alloy products and their use. It contains charts showing temperature-resistance curves and also charts showing change in resistance with temperature.

LAMP GUARDS.—The Flexible Steel Lacing Company, 4607 Lexington Street, Chicago, has added two new numbers to its "Universal" line of lamp guards, "Flexco" No. 220 and "Flexco-Lok" No. 420R.

AUTOMOTIVE INSTRUMENT.—The Cellokay Manufacturing Corporation, 175 Fifth Avenue, New York City, has developed an automotive instrument "Cell-O-Meter," which gives the exact electrical condition of the storage battery under any conditions.

INSTRUMENT STERILIZER.—The Walter Electric & Manufacturing Company, Mansfield, Ohio, has brought out the "Perfect" electric instrument sterilizer.

VACUUM CLEANER.—The Clements Manufacturing Company, 616 Fulton Street, Chicago, has placed on the market an electric "Cadillac" vacuum cleaner.

METER-TESTING SWITCH.—The Aurora Steel Products Company, Aurora, Ill., has added a meter-testing switch to its line of switches.

PORTABLE HANDLAMPS.—The Oliver Electric & Manufacturing Company, St. Louis, has brought out a line of portable handlamps with and without reflectors.

AIR COMPRESSOR.—A two-stage compressor mounted on and piped to a 32-gal. tank for stationary installation has been brought out by the Brunner Manufacturing Company, Utica, N. Y.

FIRE-ALARM SIREN.—The Erick Siren Company, Inc., 95 South Wabasha Street, St. Paul, has placed on the market an electric fire-alarm siren.

MOTOR-DRIVEN PUMP.—The Arrow Pump Company, Buhl Building, Detroit, has placed on the market a motor-driven centrifugal pump, in which it has incorporated its ring-oiled packing-gland feature.

WIRES AND CABLES.—The United States Rubber Company, 1790 Broadway, New York City, is distributing a new catalog covering its "U.S." paracore wires and cables.

CONDUIT FITTING.—The Killark Electric Manufacturing Company, Easton and Warne Avenue, St. Louis, has developed a new conduit fitting, type "Y," which is used in making a right-angle bend in rigid conduit.

LIGHTING FIXTURES.—The Crouse-Hinds Company, Syracuse, N. Y., is distributing a folder covering its various types of "Vaporproof" condulets complete with reflectors. Bulletin No. 2,001 issued by the company describes its flexible fixture hangers.

AUDIOMETER.—Adam Hilger, Ltd., 75a Camden Road, London, N. W. 1, is distributing a pamphlet describing the Low-Hilger "audiometer," formerly known as the Hilger "optical sonometer," designed to record the pressure variation caused by sound waves.

AMPERE HOUR METER.—Bulletin No. 62 issued by the Sangamo Electric Company, Springfield, Ill., covers its "Locomotive" type ampere hour meter. This meter is built especially for use on electric trucks, electric pleasure vehicles, storage-battery tractors and mine locomotives.

IGNITION COIL.—The American Bosch Magneto Corporation, Springfield, Mass., has brought out a new ignition coil, known as the Bosch "Armored", in types TC-30 and TC-40, which is described in the May issue of the *Bosch News*. The company has also developed a new type 600 Bosch ignition system for Ford cars.

CAPSTAN CAR PULLER.—The Gifford-Wood Company, Hudson, N. Y., is distributing bulletin No. 74, describing the new "G-W" electric capstan car puller.

INCLOSED KITCHENETTE.—An electrically wired kitchenette inclosed in a console-type cabinet has been brought out by the Space-Saving Furniture Company, 11 West Thirty-second Street, New York.

RECEPTACLES.—A new line of standard receptacles and plugs for convenience outlets known as "T-Slot," has been brought out by Pass & Seymour, Inc., Solvay, N. Y.

ELECTRICAL REFRIGERATING SET. —The National Refrigolier Company, Greenville, Ohio, has placed on the market an electrical refrigerating set for domestic use.

FLASHLIGHT.—A two-in-one flashlight, "Double-Duty," has been developed by the Yale Electric Corporation, Brooklyn, N. Y., which at one end gives a diffused light over a wide radius and at the other end a spotlight with focusing reflector and lens.

New Incorporations

THE OKLAHOMA HYDRO-ELECTRIC COMPANY, Oklahoma City, Okla., has been incorporated with a capital stock of $10,000 by Abram Stanfield, Tracy Wilkerson, both of Tulsa, and M. A. Schull, Oklahoma City.

THE CENTRAL QUEBEC POWER COMPANY, Quebec, Que., has been incorporated with a capital stock of $1,000,000 by Jacques Perron, Auguste Mathieu and James McCullum, all of Montreal.

THE LEAGUE CITY (TEX.) LIGHT & POWER COMPANY has been organized with a capital stock of $2,400 by W. M. Truxaw, E. T. Arnett and C. Trifton, to supply electricity in League City.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

NASHUA, N. H.—Conveying machinery and power equipment, traveling crane, etc., will be installed in the new creosote wood-treating plant to be erected at Nashua by the Boston & Maine Railroad Company, to cost about $150,000.

SHELDON SPRINGS, VT.—The Mississippi Pulp & Paper Company contemplates building a manufacturing unit and power plant, etc., to cost about $500,000.

BOSTON, MASS.—Electric power equipment will be installed in the automobile service building to be erected by the Department of Public Works, to cost about $150,000. Mulhall & Homers, 248 Boylston Street, are architects.

BOSTON, MASS.—The Edison Electric Illuminating Company is preparing plans for the construction of a substation on West Canton Street. Bigelow & Wadsworth, 3 Hamilton Place, are architects.

LOWELL, MASS.—The Lowell Electric Light Company plans an addition to its power plant, to cost about $80,000. A new steel coal and ash-handling conveyor system will be installed. Stone & Webster, Inc., 147 Milk Street, Boston, is engineer.

Middle Atlantic States

LOCKPORT, N. Y.—The Niagara, Lockport & Ontario Power Company has issued $3,000,000 in notes, part of the proceeds to be used for extension to plant to develop a maximum of 225,000 hp., and for line extensions.

MINEVILLE, N. Y.—Witherbee, Sherman & Company, 2 Rector Street, New York, contemplates rebuilding their power plant at their iron-ore properties, recently destroyed by fire with loss of about $75,000.

NEW YORK, N. Y.—Electric power equipment will be installed in the municipal repair works and reclamation building to be erected on Barren Island by the Department of Plants and Structures, for which an appropriation of $4,500,000 has been granted.

NEW YORK, N. Y.—Electric power equipment will be installed in the printing plant to be erected at 13 Frankfort Street by the Press Publishing Company, 63 Park Row, to cost about $150,000. Cross & Cross, 385 Madison Avenue, are architects.

SCOTIA, N. Y.—The Scotia Electric & Manufacturing Company, recently organized, plans to erect an electric transmission line and distributing system. J. H. Gould, Schenectady, is representative of the company.

ALLENTOWN, PA.—Plans for the proposed new relay plant to be erected by the Bell Telephone Company between Allentown and Emaus, to cost about $250,000, include an electric power plant.

ERIE, PA.—Plans are being considered by the City Council for the installation of a conduit system in East Tenth, Upper Peach, West Thirty-first, South Cherry, Parade, Liberty and East Twenty-first Streets, to cost about $70,000. F. G. Lynch is city engineer.

GLENSIDE, PA.—The Abington Township School Board has had plans prepared for a power house at the local high school. Heacock & Hokanson, 1218 Chestnut Street, Philadelphia, are architects.

HARRISBURG, PA.—The South Creek Township Electric Company, the Columbia Township Electric Company and the Springfield Township Electric Company are being organized by H. R. Palmer and F. H. Hill, Harrisburg, to construct and operate a transmission system, with distributing lines, in the townships named. Spencer G. Nauman and J. E. B. Cunningham, Harrisburg, represent the companies.

MAHANOY CITY, PA.—The Lehigh Valley Coal Company, Wilkes-Barre, Pa., is planning to install motors, controllers and other equipment at its No. 1 Park works, near Mahanoy City.

NANTY GLO, PA.—The Nanty Glo Business Men's Association and the New York Silk Manufacturing Syndicate are consider-

ing the erection of a mill and a power house, to cost about $150,000.

PHILADELPHIA, PA. — The Atlantic Refining Company, 3144 Passyunk Avenue, Philadelphia, contemplates the erection of a steam power house and pumping plant at Passyunk Avenue and the Schuylkill River.

PHILADELPHIA, PA.—A power plant will be built at the proposed bakery to be erected at 4811 Germantown Avenue by J. S. Ivins' Sons, Inc., 619 North Broad Street, to cost about $600,000. W. E. S. Dyer, Land Title Building, is engineer.

PHILADELPHIA, PA. — Plans for the proposed hat-manufacturing plant of Frank Schoble & Company, Tenth and Oxford Streets, include a power plant. William Steele & Sons Company, Arch and Sixteenth Streets, is engineer and contractor.

PITTSBURGH, PA. — Receivers for the Pittsburgh Railways Company, 435 Sixth Avenue, plan to purchase twenty electric railway motors, an electric grade shovel and other equipment.

PITTSBURGH, PA. — The Blanchard-Moshannon Mining Company, Fulton Building, recently organized with a capital of $800,000, plans to install electric power equipment and mining machinery at its properties in Clinton County.

PITTSBURGH, PA.—Bids will be received by John P. Moore, county controller, Court House, Fifth Avenue, until June 27 for electric power and lighting equipment for installation in the Liberty tunnels, now in course of erection. A. D. Neeld, Bakewell Building, is county engineer.

ANNAPOLIS, MD.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 19, for one motor-generator set for use at the local naval station. (Schedule 933.)

BALTIMORE, MD. — The Baltimore & Ohio Railroad Company contemplates the construction of a substation on its proposed general merchandise pier on the Patapsco River, to cost about $2,000,000.

PERRYVILLE, MD.—Bids will be received by the United States Veterans' Bureau, Arlington Building, Washington, D. C., until June 25 for construction of an occupational therapy building at United States Veterans' Hospital No. 42, including electrical and heating installations. Frank T. Hines is director.

WILLIAMSPORT, MD.—The Potomac Edison Company, recently organized to take over the Williamsport Power Company and to acquire and merge the Edison Electric Illuminating Company and the Cumberland Electric Railway Company, both of Cumberland, has issued $3,900,000 in bonds, the proceeds to be used in part for a steam-operated generating plant at Williamsport, with capacity of 20,000 hp., designed for an ultimate output of 240,000 hp. Extensions will be made in transmission lines.

BLUEFIELD, W. VA.—The Appalachian Power Company contemplates extensions to its electric power plants and transmission system for power service in the West Virginia coal fields.

CLIFTON, W. VA.—The Richland Coal Company contemplates the installation of electric power equipment and other machinery at its properties.

NORFOLK, VA. — The Miles Lumber Company, recently organized, is planning to build a new mill and power house, to cost about $100,000. G. Benson Ferebee is president.

ROANOKE, VA. — The Roanoke Street Railway & Electric Company plans extensions and improvements in its electric plant and system to cost about $100,000.

STAUNTON, VA.—Electrically operated pumping machinery will be installed in connection with the new water supply system for the municipal waterworks, to cost about $1,000,000. Fuller & McClintock, 170 Broadway, New York City, are consulting engineers.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until June 26 for miscellaneous fuses and fuse elements, for various navy yards. (Schedule 924.)

North Central States

GRAND RAPIDS, MICH.—Permits have been granted for buildings for the Père Marquette Railroad Company, to cost about $630,000, including a power house, to cost about $114,000, and a locomotive and boiler shop, to cost $462,000.

ISHPEMING, MICH. — The Hercules Power Company is planning to build a power plant to cost about $125,000.

LORAIN, OHIO.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system on Broadway and Erie Avenue.

PADUCAH, KY.—The Paducah Electric Company has authorized Stone & Webster, Inc., Boston, engineer, to prepare plans for a power-plant addition, to cost about $350,000. The equipment will include a 2,500-kw. generator, coal and ash-handling and conveying machinery, etc. Another plant unit of approximately the same size will be built later.

PIKEVILLE, KY.—The property and franchises of the Sandy Valley Light & Power Company have been acquired by the Kentucky & West Virginia Power Company, Pikeville, which will extend and operate the lines.

CAMBRIDGE CITY, IND.—Robert Ashe has secured permission to purchase the local municipal electric plant. A company will be formed to operate the system. Extensions and improvements will be made.

KENDALLVILLE, IND. — Plans are under consideration for extensions to the municipal electric and waterworks plant, to cost about $40,000. H. H. Mortoroff is city engineer.

MOUNT VERNON, IND.—The Southern Indiana Gas & Electric Company has been granted permission to acquire the property of the Mount Vernon Electric Light & Power Company. Additions and improvements will be made, including transmission line extensions.

WHEATFIELD, IND. — The Kankakee Valley Electric Company has received permission to purchae the Wheatfield Light & Power Company. Extensions are contemplated to the local plant and transmission lines.

CHIPPEWA FALLS, WIS.—The Wisconsin-Minnesota Light & Power Company contemplates building a power plant here.

LA CROSSE, WIS.—Plans for the proposed factory to be erected by the Weiss Manufacturing Company include a power house.

MANITOWOC, WIS. — The Manitowoc Portland Cement Company, a subsidiary of the Newaygo Portland Cement Company, Newaygo, Mich., plans to build a power plant in connection with its proposed local cement mill, to cost about $1,500,000.

ST. PETER, MINN.—Plans are under consideration for remodeling the power plant at the State Hospital, to cost about $100,000. Bids, it is understood, will be asked this summer for the work. D. F. Mullan, Capitol Building, St. Paul, is secretary of state board of control.

BONAPARTE, IOWA.—The Iowa Electric Company, Cedar Rapids, has appropriated $22,475 for a 13,200-volt transmission line from Birmingham to Bonaparte, to connect up the latter town with the Fairfield plant. The company was recently granted a franchise in Bonaparte and will install a local distributing system, to cost about $8,900.

DUBUQUE, IOWA.—The proposed new pumping station to be erected at Eagle Point by the City Water Department will be equipped with electrically operated pumping machinery.

JOPLIN, MO.—At an election to be held June 19 the proposal to issue $80,000 in bonds for improvements to the street-lighting system will be submitted to the voters.

REPUBLIC, MO.—The Lawrence County Light & Power Company, Aurora, has applied to the City Council for a franchise to supply electricity here.

STOCKTON, MO.—Bonds to the amount of $20,000 have been voted for the installation of a municipal electric light plant.

CUSTER, S. D.—Plans have been prepared by Chenoweth, Kennedy & Rittenhouse, consulting engineers, Sioux Falls, for a combined power and heating plant for the South Dakota State Sanatorium at Custer.

MADISON, S. D.—The project for the erection of a transmission line from the municipal electric plant to the Chatauqua grounds at Lake Madison has been postponed until next year.

CODY, NEB.—Bonds have been voted for the erection of an electric transmission line from Cody to the hydro-electric plant at Valentine.

HEBRON, NEB.—The Hebron Light & Power Company has consolidated with the Union Light & Power Company of Abilene, Kan. A transmission line will be erected connecting with the system of the Southern Nebraska Power Company at Deshler, the latter line being owned by the Union company.

OXFORD, KAN.—W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., engineers, have been commissioned to prepare plans for a municipal transmission line from Winfield to the Arkansas River station (5½ miles) to cost $18,000. Bonds have been voted.

Southern States

HENDERSON, N. C.—Work has started on the second hydro-electric development of the Blue Ridge Power Company on the Green River in Polk County, to be known as the Turners Shoals. It is proposed to develop 10,000 hp. at a cost of about $1,000,000.

HIGH POINT, N. C.—Plans are being prepared by the J. B. McCrary Company, Atlanta, Ga., for a hydro-electric plant and for water and sewerage systems, to cost about $100,000.

SYLVA, N. C.—Plans are in progress for the construction of a new power house at the Cullowhee Normal & Industrial School. H. A. Underwood, Raleigh, is engineer.

CAYCE, S. C.—The Pace Lumber Company, Hendersonville, N. C., plans to construct a power house at its proposed local mill.

CHARLESTON, S. C.—The installation of a new street-lighting system is under consideration by the Council. Louis D. Rubin is chairman of the lighting committee.

COLUMBIA, S. C.—The University of South Carolina will install additional equipment in the power house at the institution. Lefaye & Lefaye, Loan and Exchange Building, are architects.

HEATH SPRINGS, S. C.—Bonds to the amount of $35,000 have been voted for the installation of an electric lighting system and waterworks. The project includes the erection of an electric transmission line (11 miles) connecting Lancaster and Heath Springs, to cost about $17,300. The Ryan Engineering Company, Columbia, is engineer.

ATLANTA, GA. — A permit has been granted to the Georgia Railway & Power Company to build a substation on Stewart Avenue between Wells and Glenn Streets, to cost about $20,000.

HAMILTON, GA.—A power house will be installed at the proposed local brick and tile manufacturing plant to be built by a new company now being organized by Thomas M. Walker.

JASPER, FLA.—Preliminary surveys are being made by B. M. Hall & Sons, Atlanta, Ga., for a proposed hydro-electric plant near here.

MIAMI BEACH, FLA. — The Miami Beach Power Company plans extensions and improvements to its plant, to cost about $150,000.

TAMPA, FLA.—Plans are being considered for the construction of a power house in connection with the proposed local phosphate-fertilizer works to be built by the Chemical Construction Company, Charlotte, N. C., to cost about $1,000,000.

COVINGTON, TENN.—Steps are being taken for the construction of a municipal electric power plant, to cost about $30,000. It is proposed to use oil for fuel.

KNOXVILLE, TENN. — The Knoxville Power & Light Company has applied to the Federal Power Commission for permission to build hydro-electric plants on the Holston River with total capacity of 150,000 kw.

FLINT, ALA. — The Southern Rock Asphalt Company contemplates the construction of a power house at its proposed local refining plant, to cost about $150,000.

HUNTSVILLE, ALA. — The Council is considering the installation of an electrically operated pumping machinery in the waterworks station.

MONTGOMERY, ALA.—Work has started by the Alabama Power Company on the reconstruction of the Tallassee dam, to cost about $500,000. About 10,000 hp. will be developed and a transmission line will be erected from Montgomery to Tallassee.

LOUISVILLE, MISS.—Bonds have been approved for $30,000 for the installation of a municipal electric plant.

DOVER, ARK.—The Arkansas Light & Power Company plans to erect a transmission line from Russellville, 5 miles.

HAMMOND, LA.—The Louisiana Utilities & Manufacturing Company, recently formed with a capital of $1,000,000, plans an addition to its local power plant, including the installation of new equipment. It is also purposed to construct an ice-manufacturing and cold-storage plant.

MINCO, OKLA.—The proposal to grant a twenty-five-year franchise to the Chickasha (Okla.) Gas & Electric Company in Minco will be submitted to the voters on June 26.

CANYON, TEX.—The installation of an ornamental lighting system is under consideration.

DENTON, TEX.—A special election has been called July 7 to vote bonds for $90,000 for a municipal electric power plant, extensions in the waterworks and sewerage systems.

HOUSTON, TEX.—Contract has been awarded by the Navigation District Commission for excavation on the site of six wharves to be built on the north side of the turning basin. The plans for port improvements include construction of six wharves, grain elevator and wharf, railway yards, water supply and electric system. Bonds to the amount of $4,000,000 have been sold for the work.

WAELDER, TEX.—The City Council has granted E. Koenig a franchise to construct and operate an electric light plant here.

Pacific and Mountain States

MOUNT VERNON, WASH.—The Skagit Valley Power Company, recently organized with a capital of $400,000, plans to construct a power plant and transmission system. C. J. Henderson is interested in the company.

VANCOUVER, WASH.—The Northwestern Equipment Company, Seattle, is reported to be planning to erect a branch plant, including a power house, in Vancouver for making logging trucks.

THE DALLES, ORE.—The Pacific Power & Light Company will commence surveys for a site for a hydro-electric power plant on the Deschutes River, with initial capacity of 40,000 hp., to cost about $2,000,000.

AUBURN, CAL.—Application has been made by the American River Water & Power Company for permission to construct and operate a hydro-electric power plant on the Middle Fork of the American River to develop 150,000 hp.

BERKELEY, CAL.—The Pacific Gas & Electric Company will receive bids at once for the construction of a substation at Hearst and McGee Avenues, to cost about $50,000.

GRASS VALLEY, CAL.—Sidney Wood and associates, care of Nilon & Nilon, attorneys, have made application for permission to construct and operate a hydro-electric power plant on the Big Canyon Creek, Nevada County.

LOS ANGELES, CAL.—Application has been made by the Municipal Power Bureau for permission to construct and operate two hydro-electric power plants on Big Pine Creek, and Cottonwood Creek, with rated capacities of 27,900 hp. and 11,300 hp., respectively. The cost is estimated at $3,188,000 and $1,900,000, respectively.

LOS ANGELES, CAL.—The French China Company, Sebring, Ohio, plans to construct a power house at its proposed local pottery, to cost about $1,200,000.

SAN FRANCISCO, CAL.—The Yuba Development Company, Hobart Building, has applied for permission to construct and operate a hydro-electric power plant on the Yuba River, Yuba County, to cost about $6,000,000.

SARATOGA, CAL.—Steps have been taken by the Saratoga Improvements Club for the formation of a lighting district.

DENVER, COL.—The State Utilities Commission has granted the Colorado Power Company permission to operate plants in the towns of Antonito and Manassa. The company will take over the plants already in operation.

Canada

OWEN SOUND, ONT.—The proposal of the Hydro-Electric Power Commission of Ontario to erect a tie line connecting Eugenia with the Niagara system between Harriston and Mount Forest and a second flume at Eugenia to increase the output to 8,000 hp. has been indorsed by the Eugenia Electric Association.

TORONTO, ONT.—Work will soon begin on a large addition to the Hydro substation at Carlaw Avenue and Gerard Street, to cost about $300,000.

YORK TOWNSHIP, ONT.—An issue of $150,000 in debentures has been authorized by the Township Council to meet the cost of extensions to the Hydro-Electric power distribution system.

ST. ADEPHE-DE-CHAMPLAIN, QUE.—The Electric Service Corporation, Shawinigan Falls, has been granted permission to erect a transmission and distribution system to supply electricity here.

MORSE, SASK.—The Municipal electric light and power plant was recently damaged by fire, causing a loss of about $12,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued May 22, 1923)

1,456,300. MOTOR GOVERNOR; W. W. Dean, Wilmette, Ill. App. filed June 20, 1919. For phonograph motors.

1,456,343. ELECTRIC HEATING APPARATUS FOR WAVING OR CURLING THE HAIR; E. F. Suter, London, England. App. filed Sept. 19, 1922.

1,456,385; FUSE BOX; A. T. Kvarnstrom, Detroit, Mich. App. filed July 30, 1920. Switch or fuse box in detachable units.

1,456,420. STORAGE-BATTERY CONNECTION; B. B. Blackburn, St. Petersburg, Fla. App. filed Jan. 11, 1921. Non-corrosive terminal.

1,456,440. FLASHLIGHT ATTACHMENT FOR GUNS; J. P. Hist, Hightown, Va. App. filed March 3, 1922.

1,456,495. MANUFACTURE OF CARBON ELECTRODES; S. E. Sieurin, Hoganas, Sweden. App. filed July 31, 1920. From tar and carbon powder.

(Issued May 29, 1923)

1,456,500. ADJUSTABLE MOUNTING FOR TERMINAL BANK PANELS; O. F. Forsberg, Yonkers, N. Y. App. filed Dec. 4, 1919. Relates to automatic telephone systems.

1,456,501. DESK STAND FOR HAND TELEPHONES; O. M. Glunt, Rutherford, N. J. App. filed Aug. 19, 1920. For automatic systems.

1,456,504. ELECTRODE-SUPPORTING DEVICE; W. G. Housekeeper, New York, N. Y. App. filed April 13, 1920. For vacuum tubes.

1,456,505. ELECTRIC DISCHARGE DEVICE; W. A. Knoop, Brooklyn, and P. P. Cioffi, New York, N. Y. App. filed May 12, 1919. Electron tube.

1,456,507. TANDEM ALLOTTING SYSTEM; A. E. Lundell, New York, N. Y. App. filed May 21, 1919. Distribution of apparatus in automatic telephone systems.

1,456,508. NUMBER-INDICATING SYSTEM; A. E. Lundell, New York, and T. van Amstel, Douglaston, N. Y. App. filed July 26, 1919. Interoffice automatic telephone systems.

1,456,510. TRANSMISSION CIRCUITS; R. C. Mathes, New York, N. Y. App. filed Nov. 21, 1919. Two-way telephone repeating systems.

1,456,511. TRANSMITTER; J. P. Minton, New York, N. Y. App. filed Sept. 5, 1919. For places subjected to severe noises or vibrations.

1,456,516. CONNECTING PLUG; W. E. Riecken, Glendale, N. Y. App. filed April 26, 1918. Telephone jack.

1,456,517. MEASURING INSTRUMENT; F. W. Roller, East Orange, N. J. App. filed Oct. 22, 1920. Method of damping ammeters, voltmeters, etc.

1,456,520. ENERGIZATION AND CONTROL OF VACUUM TUBES; H. E. Shreeve, New York, N. Y. App. filed May 28, 1921. For telephone systems.

1,456,523. METHOD OF AND APPARATUS FOR TREATING METALS; R. F. Trimble, Elizabeth, N. J. App. filed July 19, 1919. Manufacture of electron tube elements.

1,456,528. ELECTRIC DISCHARGE DEVICE; H. D. Arnold, East Orange, N. J. App. filed May 10, 1915. Vacuum tube with large current output.

1,456,533. TYPEWRITING MACHINE; P. H. Burdick, Geneva, Ill. App. filed Nov. 6, 1920. Magnetically operated.

1,456,534. PRINTING TELEGRAPHY; H. A. Burgess, New York, N. Y. App. filed Nov. 25, 1919. Receiving apparatus of type-bar sort.

1,456,536. TELEPHONE SYSTEM; E. H. Clark, New York, N. Y. App. filed Dec. 4, 1919. Selective signaling apparatus for subscribers' lines.

1,456,537. TELEPHONE EXCHANGE SYSTEM; E. H. Clark, Richmond Hill, N. Y. App. filed May 19, 1920. Relates to machine-switching apparatus.

1,456,538. ACOUSTIC APPARATUS; I. B. Crandall, New York, N. Y. App. filed Dec. 24, 1917. Telephone receiver.

1,456,549. COMPOSITE SIGNALING CIRCUITS; B. P. Hamilton, Brooklyn, N. Y. App. filed Aug. 29, 1919. Plurality of signaling channels imposed upon same circuit.

1,456,550. ELECTRIC DRIVE MECHANISM; G. E. Hampton, Pittsburgh, Pa. App. filed Jan. 10, 1917. Reciprocatory element employed.

1,456,556. DUPLEX TELEGRAPH SYSTEM; E. A. Hudson, Brooklyn, N. Y. App. filed Dec. 29, 1921. For full duplex operation and half duplex operation.

1,456,568. MULTIPLE-FILAMENT LAMP; G. E. Quandt, Lockport, N. Y. App. filed June 29, 1922. Extra filament connected into circuit when lamp burns out.

1,456,591. THERMAL AMMETER; W. N. Goodwin, Jr., Newark, N. J. App. filed March 24, 1920.

1,456,595. RECORDING APPARATUS; C. A. Hoxie, Schenectady, N. Y. App. filed April 13, 1918. Recording photographically radio signals.

1,456,602. CALLING DEVICE; W. Kaisling, Chicago, Ill. App. filed Jan. 17, 1920. Dial for automatic telephone system.

1,456,652. ELECTRIC POWER GENERATING SYSTEM; A. M. Rossman, Chicago, Ill. App. filed June 11, 1921. Method of increasing power-plant efficiency.

1,456,658. ALTERNATING-CURRENT COMMUTATOR MOTOR; O. Turk and J. Kozisek, Charlottenburg, Germany. App. filed Oct. 29, 1915.

1,456,742. SOUND TRANSMITTER; P. V. Rooney, Morristown, N. J. App. filed April 4, 1921. For large powers met with in the operation of wireless or radio telephony.

1,456,746. CABLE TERMINAL FOR ARC LAMPS; T. F. Uhlemann, New York, N. Y. App. filed Nov. 29, 1918. For motion-picture machines.

1,456,755. ELECTRICAL HEATING APPARATUS; P. Bergeon, Grenoble, France. App. filed Oct. 6, 1921.

1,456,760. ELECTRIC SOLDERING IRON; F. W. Borton, Miami, Fla. App. filed Oct. 18, 1921. Used with electric currents of any voltage.

1,456,792. CONDUIT OUTLET BOX; W. G. Franke, Detroit, Mich. App. filed Dec. 15, 1919. Sectional outlet box.

1,456,798. PROCESS FOR THE EXTRACTION OF LEAD FROM SULPHIDE ORES; W. H. Hannay, Trail, British Columbia, Can. App. filed April 30, 1920. By electrolysis.

1,456,851. BINDING ELEMENT; C. F. Kettering, Dayton, Ohio. App. filed Jan. 6, 1922. Preparatory to heating in induction furnace.

1,456,863. ELECTRIC HEAT-RADIATING DEVICE FOR WATER-HEATING SYSTEMS; T. J. Blong, St. Louis, Mo. App. filed Feb. 14, 1921.

1,456,865. TERMINAL FOR ELECTRIC FURNACES; P. H. Brace, Wilkinsburg, Pa. App. filed April 21, 1921. Water-cooled electrode terminals.

1,456,867. APPARATUS FOR THE RECEIPT OF WIRELESS IMPULSES; F. Conrad, Pittsburgh, Pa. App. filed May 15, 1919. For remote control of electrical apparatus.

1,456,873. ALUMINUM DIRT TRAY AND REFLECTOR; F. F. Forshee, Flint, Mich. App. filed July 19, 1920. For placing under heating elements of electric stoves.

1,456,878. ELECTRICAL HEATING DEVICE; M. M. Kohn, New York, N. Y. App. filed Jan. 28, 1921. Toaster.

1,456,891. ELECTRIC FURNACE RESISTOR; G. M. Little, Pittsburgh, Pa. App. filed May 24, 1921. Built-up resistor of carbonaceous elements compressed in chamber.

1,456,892. PROTECTED ELECTRODE FOR ELECTRIC FURNACES; G. M. Little, Pittsburgh, Pa. App. filed May 24, 1921.

1,456,893. ELECTRIC FURNACE WALL CONSTRUCTION; G. M. Little, Pittsburgh, Pa. App. filed May 24, 1921.

1,456,894. TELESCOPING ELECTRODE PROTECTOR; G. M. Little, Pittsburgh, Pa. App. filed May 24, 1921. Protecting exposed portion of carbonaceous electrode.

1,456,901. TANK OR VESSEL FOR ELECTROLYTIC APPARATUS AND OTHER PURPOSES; R. D. Merson, New York, N. Y. App. filed Jan. 8, 1920. Apparatus airtight but provided with breathing means.

1,456,907. ELECTRIC HEATER FOR FLUIDS; C. T. Penton, Detroit, Mich. App. filed Aug. 17, 1921.

1,456,909. WAVE CONDUCTOR; M. I. Pupin, Norfolk, Conn. App. filed Oct. 10, 1918. For balancing the phase and amplitude of alternating electro-motive force waves.

1,456,923. TRAFFIC SIGNAL OR INDICATOR; A. C. Fowls, New Philadelphia, Ohio. App. filed March 27, 1920. For automobiles.

1,456,927. WRITING PAD; D. M. Kumpf, Pekin, Ill. App. filed April 14, 1922. Electrically illuminated.

1,456,937. HIGH-VOLTAGE PANCAKE-TYPE COIL; A. Schneeberger, Turtle Creek, Pa. App. filed June 13, 1917. Employed in shell-type transformers.

1,456,941. ELECTROLYTIC CELL; J. Slepian, Wilkinsburg, Pa. App. filed Dec. 9, 1919. Serves as condenser and lightning arrester.

1,456,955. MEANS FOR OBTAINING HIGH MOMENTARY CURRENT; C. F. Wagner, Pittsburgh, Pa. App. filed Feb. 26, 1921. For electro-percussive welding machine.